



Section B: Spatial Planning and Targeting



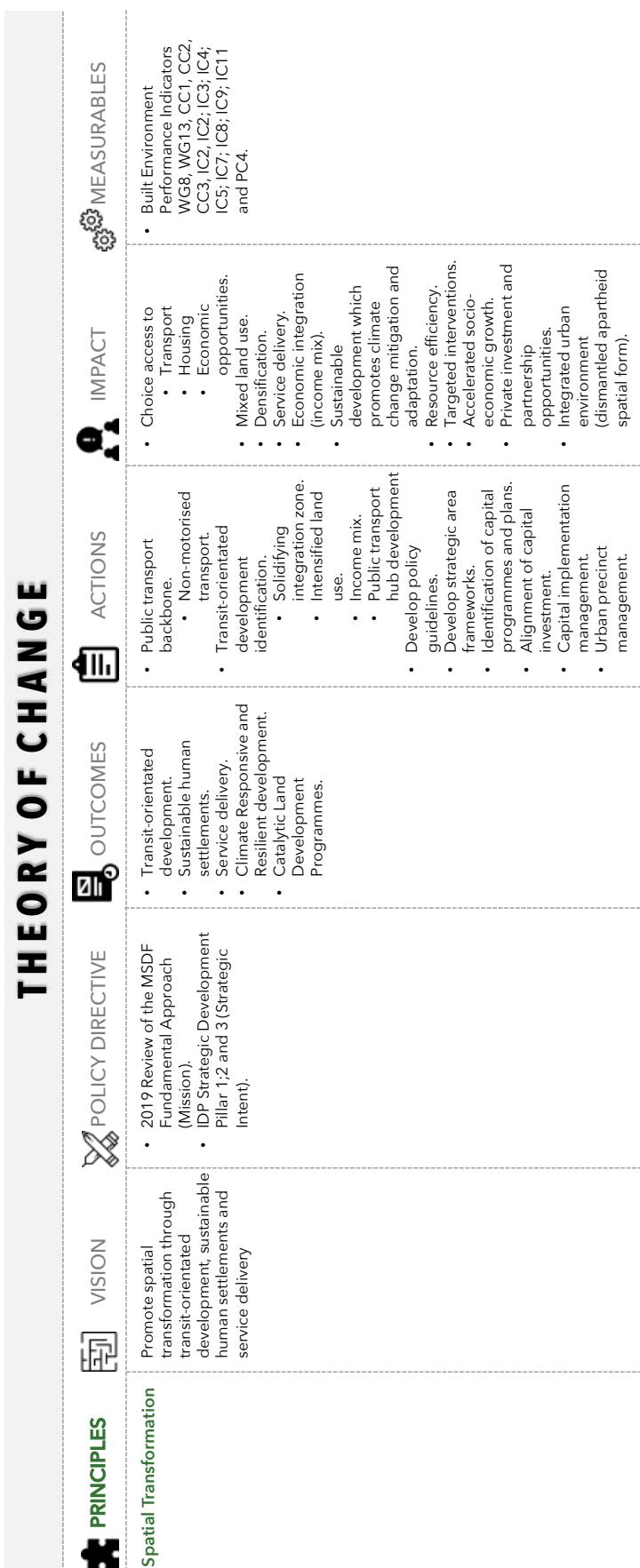
Section B: Spatial Planning and Targeting

Spatial targeting is the deliberate focus of an action on a particular spatial area in order to achieve an improvement or transformation in the area as a result of the focussed action. These focussed actions could take the form of any policy instrument, namely planning reforms, design guidelines, urban management interventions, targeted capital investment or expenditure etc. In a legislative and performance measurement environment, it is a useful tool to assist organisations responsible for built environment interventions and management to achieve organisational objectives more effectively. Spatial targeting is possible under the following conditions:

- Spatial strategies of the organisation are expressed in strategic documentation;
- Planned interventions are spatially referenced;
- The scope of planned interventions or actions are clearly defined, and;
- The beneficiary or impact area of interventions are spatially referenced.

In terms of the City's Theory of Change, the concept behind spatial targeting aligns to the principle of spatial transformation and includes promoting transit orientated development, sustainable human settlements and service delivery. It is important to note the intra- and inter- dependency between that of financial sustainability and good governance principles (the other focal points of the City's Theory of Change). Spatial transformation requires sustainable funding resourcing and good governance principles to succeed, but also plays a vital role in determining the "where?" and "why?" for funding resourcing.

Figure 10 Theory of Change



The vision of the City to achieve spatial transformation derives from the National Development Plan 2030, the Draft 2019 MSDF's fundamental approach to spatial vision together with the IDP strategic vision to facilitate economic growth and job creation; to promote inclusivity; to deliver services and to protect the environment.

To achieve this the City needs to support the outcomes as set out in Figure 10 above through actioning the identification of a public transport backbone; transit orientated development; clear policy directives and strategic frameworks. Through actioning these outcomes, spatial transformation will promote densification in targeted areas through improved choice and access to transport options, sustainable housing and increased economic development and access to employment opportunities. This will also enable the City to prioritise areas for investment and to achieve the outcome of Catalytic Land Development Preparation (CLDP).

In terms of the BEVC, the following section has been structured to align to the starting premise of the value chain and describes the context of the Urban Network Structure (UNS) together with climate responsiveness and resilience relating to the City's spatial structuring elements.

Spatial targeting within the municipal environment, and specifically the BEPP, refers to the deliberate focussing of capital investment in spatially targeted areas in order to achieve municipal objectives more efficiently. Spatial targeting is thus focussed on optimising the spatial distribution of current and future capital investment in terms of the spatial structuring elements of the City, areas vulnerable to climate change impacts and other areas of strategic spatial and economic importance to the City.

During the 2019/20 reporting period, the City has embarked on aligning climate risk mitigation and adaptation as part of the spatial transformation principle. The information contained within this section will refer to both climate adaptation and mitigation strategies. From an adaptation point of departure, reference will be made to the Vulnerability Assessment to Climate Change report (2015) and for purposes of mitigation, reference will be made to the Green House Gas Emissions Inventory for 2014/15. In conclusion to this section, the institutional framework will include the way forward in terms of the City Sustainability Unit and actions which have been identified to mainstream Climate Change Mitigation and Adaptation.

8 Spatial Structuring Matrix

Policy makers, role players and thought leaders associated with the built environment profession often develop their own logical framework to make sense of the complex built environment. The result of these frameworks often results in a myriad of planning framework concepts, terminology and acronyms describing the same spatial structuring elements within the City. The resulting confusion around terminology and spatial structuring element naming conventions often leads to confusion, wasted discourse and potential misguidance. There is however a common thread that links all of the built environment planning framework concepts that was conceptualised over time, namely:

- a rationalisation of hierarchy of structuring elements;
- priority associated with structuring elements, and;
- the delineated areas of the structuring elements themselves.

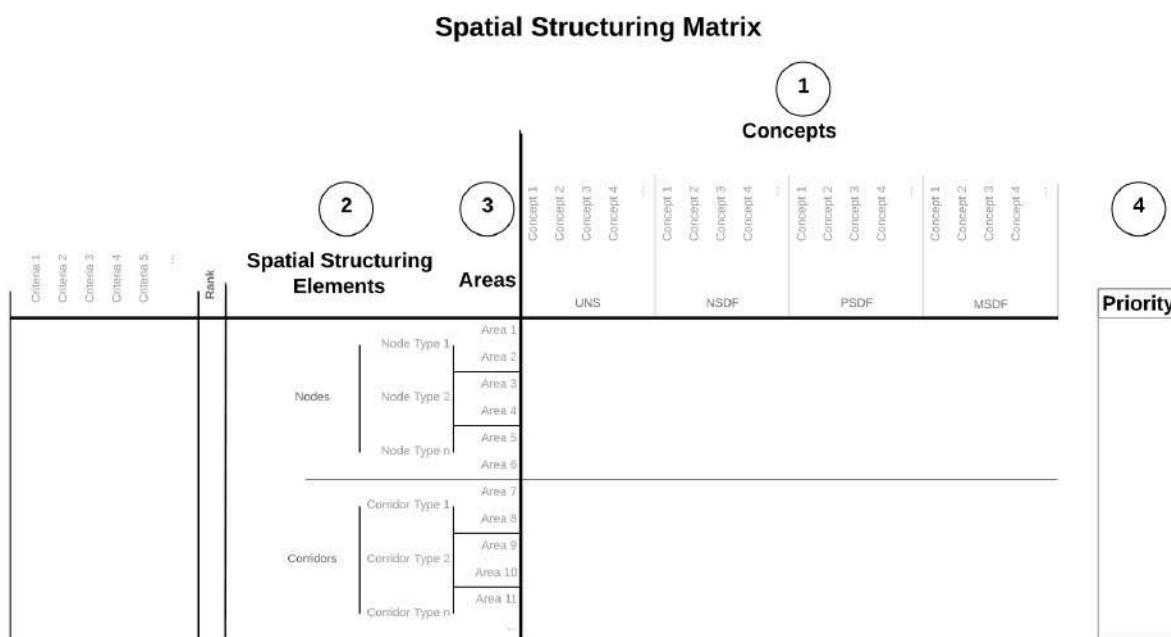
In order to eliminate confusion regarding terminology and naming conventions applied to spatial structuring elements within the City, a Spatial Structuring Matrix was conceived to create a common narrative for spatial structuring and spatial targeting for the City. The compilation of the City's Spatial Structuring Matrix intends to:

- Firstly, identify the different planning framework concepts that describe, guide and impact particular areas in the City;
- Secondly, determine the fundamental spatial structuring elements in the City;
- Thirdly, delineate and assign the areas in the City to the fundamental spatial structuring elements in the City, as well as the concepts governing the areas in the City;
- Fourthly, assign priority to the spatial structuring elements and areas in the City, and;
- Lastly, guide private sector as to what the spatial vision is for each spatial structuring element or area across all spheres of government (i.e. local, provincial and national government).

Figure 11 shows the key building blocks that comprise the Spatial Structuring Matrix, namely:

- Planning framework concepts;
- Spatial structuring elements;
- Areas, and;
- Priorities.

Figure 11 The key building blocks of the City's Spatial Structuring Matrix



8.1 Planning Framework Concept Alignment

The purpose of this section is to identify and define the different planning framework concepts that describe, guide and impact particular areas in the City.

Different spheres of government have introduced various spatial structuring concepts across the years, attempting to create a spatial definition and structuring toolbox for planners. By aligning the planning framework concepts into a single spatial structuring matrix, it will be possible to translate

different spatial definitions with each other, and in so doing, establishing clear parameters for each planning framework concept as well as the context where each planning framework concept is applicable. Only the most recent and relevant planning framework concepts will be used to compile the Spatial Structuring Matrix, and this does not represent a comprehensive historical assessment of planning framework concepts used to date.

8.1.1 Concept Sources Documents

The different planning framework concepts and rationales currently influencing the delineation of the City of Tshwane includes the following:

- National Treasury – Built Environment Performance Plan Guidelines: **Urban Network Structure**;
- National Department of Corporate Governance – **Capital Expenditure Framework Guidelines**: Functional Areas and Priority Development Areas;
- National Department of Rural Development and Land Reform – **National Spatial Development Framework**;
- Provincial Government of Gauteng – **Gauteng Spatial Development Framework**, and;
- City of Tshwane – **Metropolitan Spatial Development Framework**.

8.1.1.1 Urban Network Structure

Custodian:	National Treasury
Origin:	Built Environment Performance Plan (2016)
Number of Spatial Structuring Concepts:	Seven (7)
Purpose:	To create a nationally unified language between the metropolitan municipalities with respect to spatial structuring elements.
Scale to which it applies:	Local or sub-regional

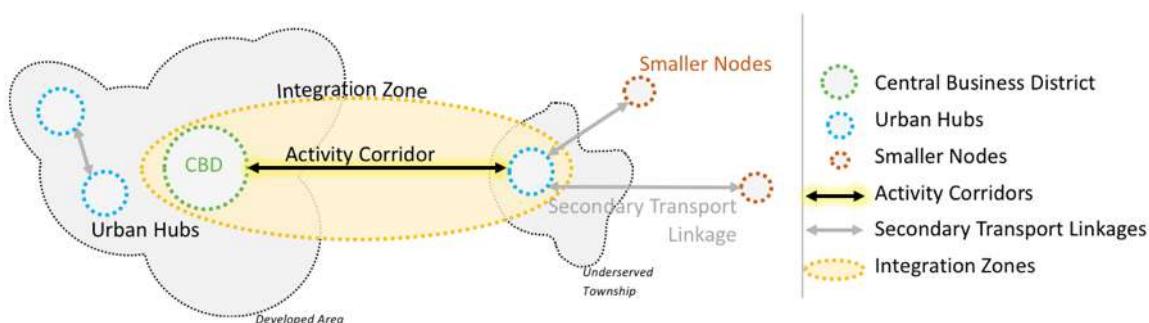


Table 4 Urban Network Structure – list of concepts

UNS List of Planning Framework Concepts
Activity Corridors

UNS List of Planning Framework Concepts
Central Business District
Integration Zones
Secondary Transport linkages
Smaller Nodes
Underserved Townships
Urban Hubs

8.1.1.2 Functional Areas and Priority Development Areas

Custodian:	National Department of Corporate Governance
Origin:	Capital Expenditure Framework Guidelines (2018)
Number of Spatial Structuring Concepts:	Two (2)
Purpose:	To define and delineate areas for socio-economic profiling, analysis, modelling and reporting.
Scale to which it applies:	Functional areas covers the municipal jurisdiction or sub-region, whereas Priority Development Areas have a local scale associated with them.

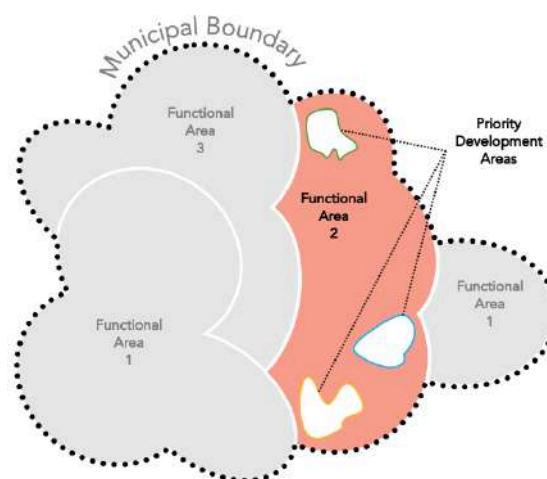


Table 5 CEF Guidelines – List of concepts

CEF List of Planning Framework Concepts
Functional Areas
Priority Development Areas

8.1.1.3 National Spatial Development Framework

Custodian:	National Department of Rural Development and Land Reform
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Origin:	Spatial Planning and Land Use Management Act (2013)
Number of Spatial Structuring Concepts:	Five (5) Outcomes Five (5) Sub-Frames Five (5) Action Areas 21 Structuring Elements
Purpose:	To give effect to national priorities, policies and desired land patterns.

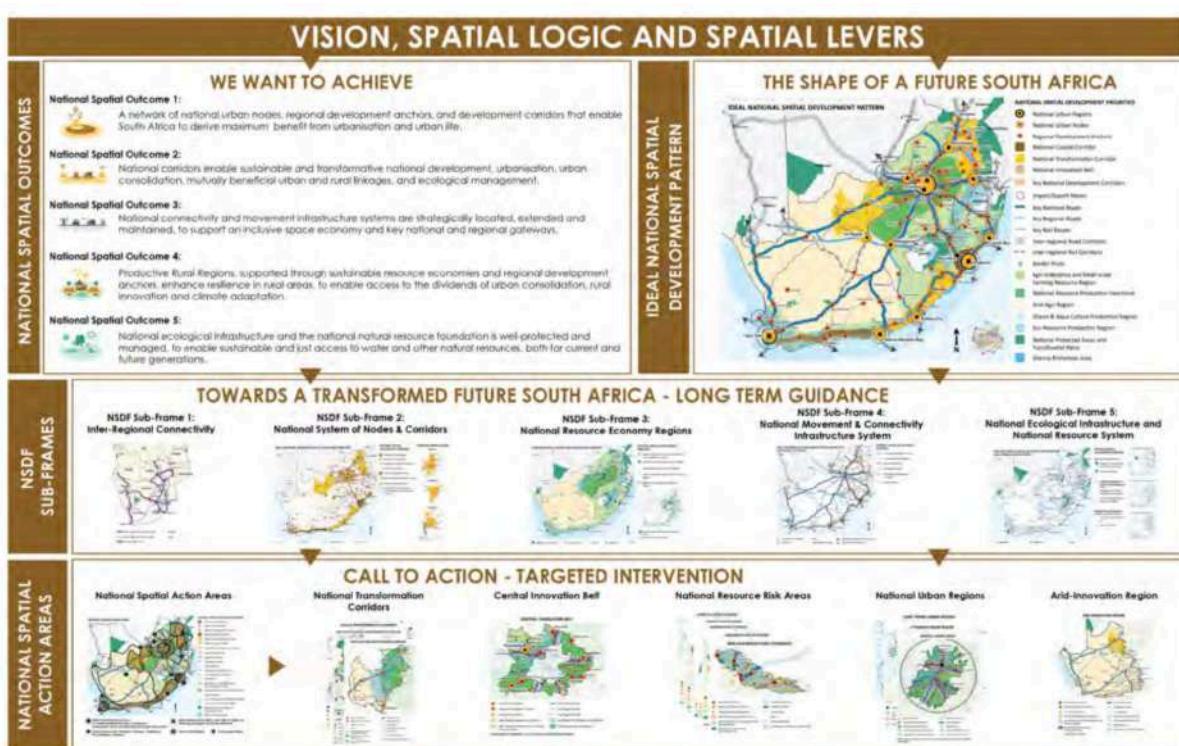


Table 6 National Spatial Development Framework – List of concepts

NSDF List of Planning Framework Concepts	
Agri Enterprise and Small-Scale Farming Resource Regions	
Arid Agri Region	
Border Posts	
Eco Resource Production	
Import / Export Nodes	
Inter-Regional Rail Corridors	
Inter-Regional Road Corridors	
Key National Development Corridors	
Key National Roads	
Key Rail Routes	
Key Regional Roads	

NSDF List of Planning Framework Concepts
Marine Protection Area
National Coastal Corridor
National Innovation Belt
National Protected Areas And Trans Frontier Parks
National Resource Production Heartland
National Transformation Corridor
National Urban Nodes
National Urban Regions
Ocean & Aqua Culture Production Region
Regional Development Anchors

8.1.1.4 Provincial Spatial Development Framework

Custodian:	Gauteng Spatial Development Framework
Origin:	Spatial Planning and Land Use Management Act (2013)
Number of Spatial Structuring Concepts:	Five (5) Focus Areas 27 Structuring Elements
Purpose:	To give spatial development guidance within the Gauteng City Region.
Scale to which it applies:	Provincial and Sub-regional

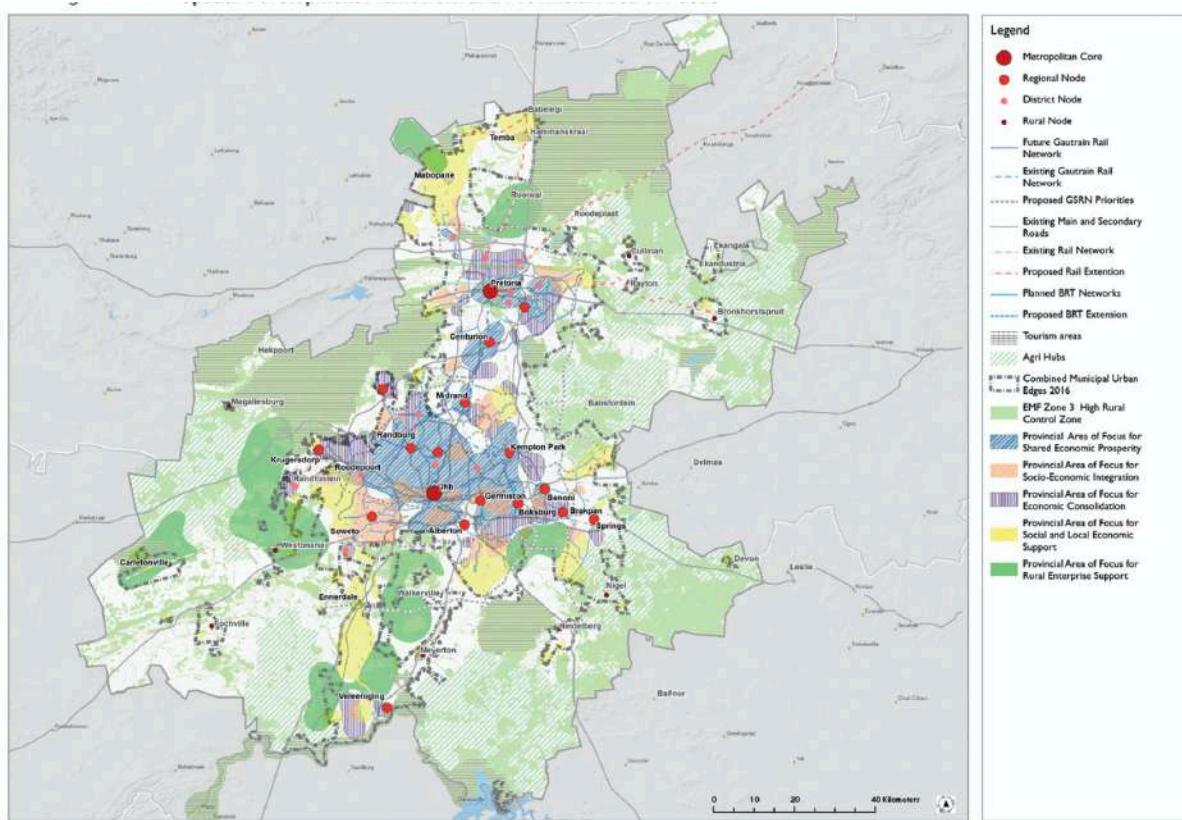


Table 7 Provincial Spatial Development Framework

Provincial SDF List of Planning Framework Concepts	
Agri Hubs	
BRT Network	
Combined Urban Edge	
District Node	
EMF Zone 3	
Gautrain Rail Network	
Local Node	
NDP Hub	
Metropolitan Core	
Proposed GSRN Priorities	
Provincial Area of Focus for Economic Consolidation	
Provincial Area of Focus for Rural Enterprise Support	
Provincial Area of Focus for Shared Economic Prosperity	
Provincial Area of Focus for Social and Local Economic Support	
Provincial Area of Focus for Socio-Economic Integration	
Rail Network	
Regional Node	
Rural Node	
Tourism Areas	

8.1.1.5 Metropolitan Spatial Development Framework

Custodian:	City of Tshwane
Origin:	Spatial Planning and Land Use Management Act (2013)
Number of Spatial Structuring Concepts:	More than 30
Purpose:	To provide a spatial representation of the City's spatial vision and to be a tool to integrate spatial planning concepts, which in turn guides spatial interventions and decision-making processes.
Scale to which it applies:	Sub-regional and local

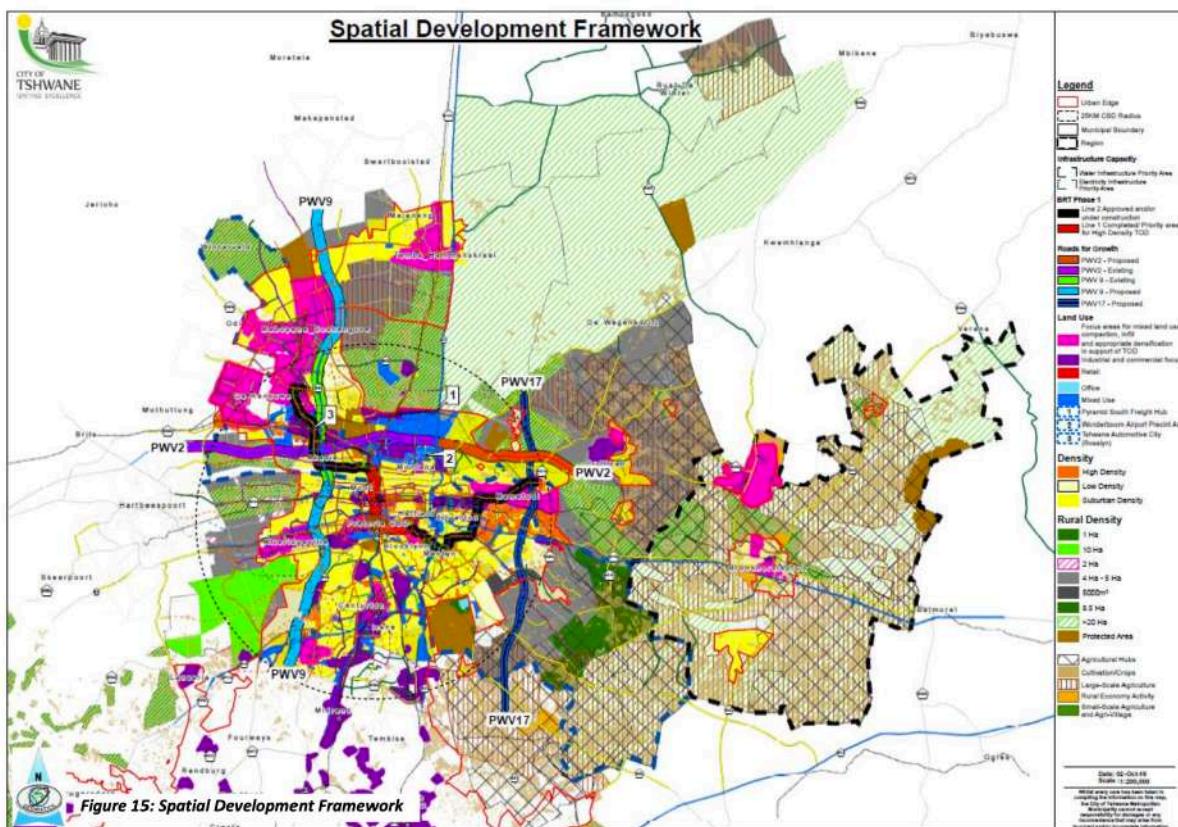


Table 8 Metropolitan Spatial Development Framework – List of concepts

MSDF List of Planning Framework Concepts
Agricultural hubs
BRT Phase 1 – Approved / under Construction
BRT Phase 1 – Completed
Cultivated Crops
Focus Area for mixed land use, compaction, infill, densification
High density
Industrial and commercial focus

MSDF List of Planning Framework Concepts
Large scale agriculture
Low density
Mixed Use
Office
Protected area
Retail
Road for Growth – PWV 17
Road for Growth – PWV 2
Road for Growth – PWV 9
Rural density
Rural Economy activity
Small scale agriculture and Agri-village
Suburban density
Urban Edge

8.1.2 Planning Framework Concept Summary

The concepts in each of the afore mentioned policies, guidelines and frameworks brings about specific outcomes as to what that policy, guideline or framework wishes to achieve in the City with regards to spatial planning and targeting. Each of these outcomes are captured in concepts and are baptised with their own unique terminology and naming conventions. These terminology and naming convention differences unfortunately often result in a great deal of interpretation variation and confusion within various sectors and distorts spatial targeting efforts.

The rationalisation of planning policy, guideline and framework concepts as a step towards achieving spatial targeting, can be compared to a game of darts. The organisations, internal divisions and departments or role-players represent the dart players. The dartboard itself represents the area of jurisdiction of the city. The bullseye represents what role-player wants to focus on, and the number of darts represents the limited resources and affordable interventions to achieve the desired outcome. Each organisation has defined their own bullseye, on the same dartboard; and are expecting players (organisations, internal divisions and departments or role-players) to throw their limited number of darts, at the target they defined as most important.

The problem defined above, in itself, cannot be changed by the City. However, the City can attempt to best align its spatial targeting initiatives, in line with evidence-based planning as opposed to abstract, concept-based planning – a transition from the status quo.

Figure 12 shows the terminology used in the different policies, guidelines and frameworks; attempting to describe the same areas. For more information on the definition of each term, please refer to the respective policy, guideline and framework documents cited.

Figure 12 Spatial Structuring Matrix – Part 1: Concepts

CONCEPTS	Urban Network Structure	CEF Guidelines	National SDF	Provincial SDF	Metropolitan SDF
	<ul style="list-style-type: none"> • Central Business District • Urban Hubs • Smaller Nodes • Underserved Townships • Integration Zone • Activity Corridor • Secondary Transport Linkage • 	<ul style="list-style-type: none"> • Functional Areas • Priority Development Areas • 	<ul style="list-style-type: none"> • National Urban Regions • National Urban Nodes • National Transformation Corridor • National Innovation Belt • Key National Development Corridors • Inter-Regional Corridors • Agri enterprise and Small-Scale Farming • Eco Resource Production 	<ul style="list-style-type: none"> • Metropolitan Cores • Regional Nodes • Area of Rural Enterprise Support • Area of Shared Economic Prosperity • Area of Socio-Economic Integration • Area of Economic Consolidation • Area of Local Economic Support 	<ul style="list-style-type: none"> • Urban Cores • Capital Core • Precincts • PWV 2 • High Density • Rural Economy Activity • Metropolitan Nodes • BRT Phase 1 • PWV 17 • PWV 9 • Protected Areas • Area for Mixed Development • Low Density • Agricultural Hubs • Large Scale Agriculture • Agri-Village

8.2 Spatial Structuring Elements Classification Methodology

The purpose of this section is to provide a methodology which can be applied to determine the fundamental spatial structuring elements of a city. The proposed methodology identifies the most fundamental spatial structuring elements of a city, namely nodes and corridors – with a typological differentiation for each of the respective spatial structuring elements.

With respect to nodes, a structure analysis is proposed, comprising a four-part assessment:

- Private transport movement lattice – Accessibility;
- Public transport movement lattice – Interchanges;
- Public realm, and;
- Activity anchors and clusters.

With respect to corridors, the structural analysis proposed comprise a three-part assessment:

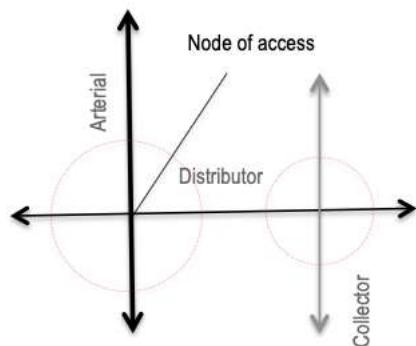
- Land use lattice – Origin and destinations;
- Population dynamics – Transport characteristics, and;
- Transport demand – Determining volumes.

8.2.1 Nodal Assessment Methodology

8.2.1.1 Private Transport Movement Lattice – Accessibility

The level of access is the primary determinant of an urban environment's nodal structure. Simply put, the greater the level of access to a particular point, the higher the development potential of that area. From a nodal identification and classification perspective, the greater the level of accessibility at a private transport network junction, the higher the nodal classification within the structuring hierarchy. To determine this, calculate the number of intersections between arterial, distributor and collector roads per evaluation area. This calculation contributes to the final score per evaluation area, which forms the evidence based underbuilt for nodal delineation.

Figure 13 Private Transport Movement Lattice – Accessibility

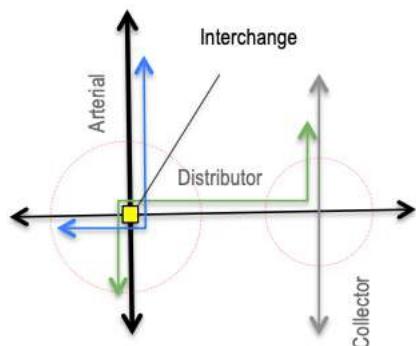


8.2.1.2 Public Transport Movement Lattice – Interchanges

The zones of greater access created by the private transport movement lattice and network hierarchy are often strengthened by a public transport system in the form of public transportation interchange points. These are places where transport modal and directional change are possible. Public transport interchanges are identified at the junction of a number of public transport service lines.

To determine this, calculate the number of public transport intersections, and calculate the number of public transport service lines and private transport intersections between arterial, distributor and collector roads per evaluation area. This calculation contributes to the final score per evaluation area, which forms the evidence based underbuilt for nodal delineation.

Figure 14 Public Transport Movement Lattice – Interchanges

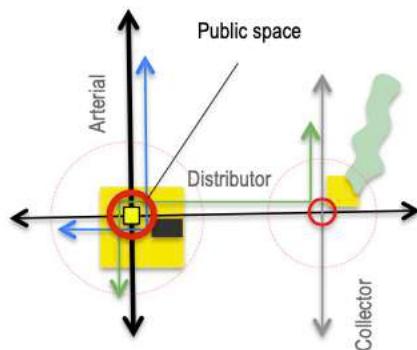


8.2.1.3 Public Realm

Owing to higher accessibility, public transport interchange points generate larger flows of people, which transforms the node into “public space”. These public spaces become landmark areas where public beacons and public amenities such as squares or parks are placed.

To determine this, calculate the number of public amenities per evaluation area. This calculation contributes to the final score per evaluation area, which forms the evidence based underbuilt for nodal delineation.

Figure 15 Public Realm

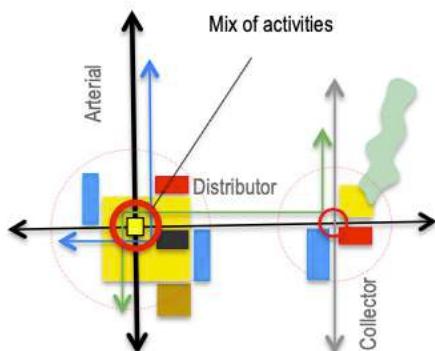


8.2.1.4 Activity Anchors and Clusters

The heightened level of access and the extent of public interaction at prominent nodes provide an opportunity for government and the public to connect. Public nodes attract a mix of activities through the clustering of social and commercial activities at the points of highest accessibility. The clustering of facilities also promotes a form of demand management as a multiple of needs can be met by making one trip.

To determine this, calculate the inverse weighted area average area of commercial activities and social activities, per evaluation area. This calculation contributes to the final score per evaluation area, which forms the evidence based underbuilt for nodal delineation.

Figure 16 Anchors and Clusters



8.2.2 Corridor Assessment Methodology

8.2.2.1 Population Dynamics – Transport Characteristics

An assessment of the demographic spatial orientation of the City include the evaluation of the population dynamics across the City; which includes population density, income levels, car ownership etc. When it comes to corridor identification, these dynamics plays a vital role when identifying future demand, the designing corridor characteristics such as modes of transport, and determining route alignment.

To determine this, calculate population density per evaluation area, the weighted average income levels per evaluation area, and car ownership percentage per evaluation area. This calculation contributes to the final score per evaluation area, which forms the evidence based underbuilt for corridor delineation.

8.2.2.2 Land-use Lattice – Origins and Destinations

An assessment on the commercial and employment orientation of the City is significant when determining the different origins and destinations within a city. This essentially determines the starting point and ending point of the corridors. It directly relates to how people will move within the City.

To determine this, calculate the m² of commercial usage per evaluation area, as well as the m² residential usage per evaluation area. This calculation will contribute to the final score per evaluation area, which will form the evidence based underbuilt for corridor delineation.

8.2.2.3 Transport Demand – Determining Volume

An assessment of exiting transport demand of the City is done, as it, together with the previous two characteristics, define the peak hour passenger trips per demand corridor per direction; which will give insight as to what the most efficient routes will be. Simply put, the more trips along a specific route, the better economic and social benefit will be when deploying a corridor along a specific route.

To determine this, calculate the peak hour passenger trips per direction per evaluation area. This calculation contributes to the final score per evaluation area, which forms the evidence based underbuilt for corridor delineation.

8.2.3 Spatial Structuring Element Typologies

8.2.3.1 Nodes

When considering the context and hierarchy of nodes within the City, it is evident that each node varies in its prominence and significance on a regional scale and is oriented to a different urban function. A number of nodes, however, have similar characteristics and may therefore have a similar function. Nodes can therefore be categorised by type and a list of generalised nodal types has been defined, with the intention to:

- Define fundamental spatial structuring elements;
- Outline key planning and urban design consideration as a launching point for more detailed nodal planning;
- Clarify expectation with regard to the intended role, function and character of a specific node, and;
- Differentiate in priority.

The following nodal typologies have been identified for the City in keeping with the various planning framework concepts discussed earlier. The following nodal typologies have been defined:

- **Transit Centre** - A transit centre is characterised as a hub of accessibility, served by multiple modes of transit. Owing to the convergence of transit activity, transit centres have a higher ranking within the station hierarchy and are typically centres of regional significance. As anchors of activity, transit stations within transit centres function as prominent public spaces and are characterised by generally higher levels of use. With consideration of the foot traffic that is generated within such a precinct, transit centres are typically characterised with a strong mix of transit supportive land uses, pedestrian focused design and an urban structure that is oriented to the station. Transit centres are characterised predominantly by non-residential land uses, but the provision of integrated

housing stock is becoming increasingly important. The urban form is characterised by small block sizes, higher site coverage, higher intensities and densities of development, the integration of civic open spaces, and minimal surface parking.

- Activity Centre - Activity centres represent significant centres of economic and cultural activity with regional-scale destinations that are well served by public transit. Activity centres are differentiated from transit centres by the orientation of land use. In the case of transit centres, land uses are orientated to the station i.e. land uses support the station, whilst in the case of activity centres, the station is oriented to the activity i.e. the station supports the land use. Owing to the intensity of activity, these centres may function as employment nodes, but also provide for a diverse housing stock. Much like transit centres, activity centres are characterised by small block sizes, high site coverage, higher intensities and densities of development, public space that serve as gathering spaces and minimal surface parking.
- Employment Centre - Employment centres are areas with specialised land uses with a focus on economic activity. Land use therefore typically comprises commercial, employment and civic uses with only a small residential component. Employment centres may have a regional or local function.
- Community Centre - Community centres function as local centres of economic and community activity served by one or more transit types that provide good access to regional centres. Community centres provide supporting services and opportunities to neighbourhood centres, but also have an important function with regards to housing provision and the mix of uses is therefore more balanced between residential and commercial/employment uses. Block sizes, site coverage, and development densities tend to be moderate in comparison to transit and activity centres.
- Neighbourhood Centre - Neighbourhood centres represent stations on the lower end of the station hierarchy. These stations have a localised function and are dominated by residential land uses. Non-residential land uses are limited to local-serving retail and community services. Residential densities in neighbourhood centres tend to be lower than those in community centres and are at their highest within the concentration and transit promotion zones.

8.2.3.2 Corridors

When considering the context and interaction towards corridors within the City, it is appreciated that each corridor varies in its prominence, significance, scale, and progress in development and so is oriented to different function(s). A number of corridors, however, have similar characteristics and may therefore have similar functions. The corridors can since be categorised by type. In so doing, a list of generalised corridor types has been defined with the intention to:

- Define fundamental spatial structuring elements;
- Outline key planning and urban design consideration as a launching point for more detailed corridor planning;
- Clarify expectation with regard to the intended role, function and character of a specific corridor, and;
- Differentiate in priority.

The following corridor typologies have been defined:

- Primary Movement Corridors – Primary movement corridors are corridors whose demand is in excess of 6 000 peak hour passengers per direction and are earmarked for trunk routes in the Integrated Public Transport Network.
- Secondary Movement Corridors – Secondary movement corridors are corridors whose demand is less than 6 000 peak hour passengers per direction and are earmarked for feeder routes in the Integrated Public Transport Network.

8.2.4 Spatial Structuring Element Summary

Spatial structuring elements are grouped into two broad categories, namely Nodes and Corridors. These categories are then further refined into a hierarchy of elements. In the case on nodes, the hierarchy of elements translates as follows:

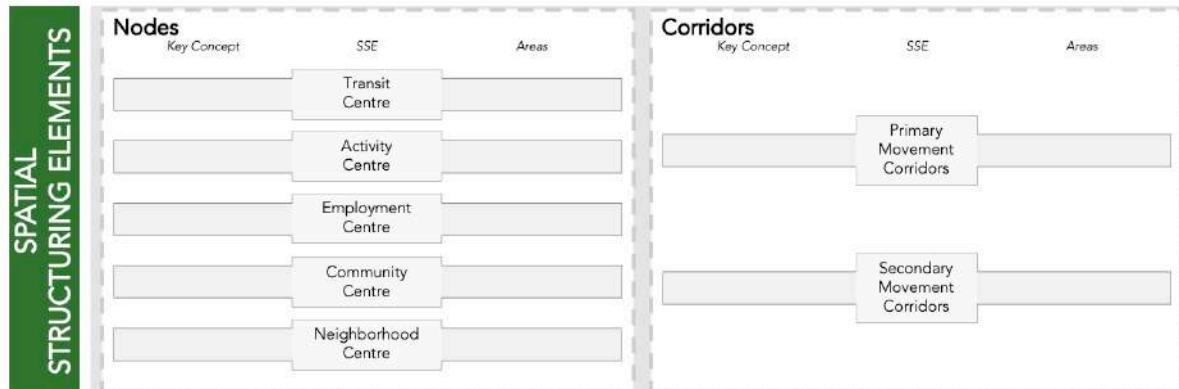
- Transit Centres
- Activity Centres
- Employment Centres
- Community Centres
- Neighbourhood Centres

In the case of corridors, the hierarchy of elements translates as follows:

- Primary Movement Corridors
- Secondary Movement Corridors

Figure 17 shows a summary of the fundamental spatial structuring elements, together with their typological elements.

Figure 17 Spatial Structuring Matrix: Part 2: Spatial Structuring Elements



8.3 Concept Alignment and Area Assignment

The purpose of this section is to firstly align key concepts within the constellation of concepts to the fundamental spatial structuring elements, and secondly to assign the various areas in the City to the fundamental spatial structuring elements identified as part of the planning framework concepts

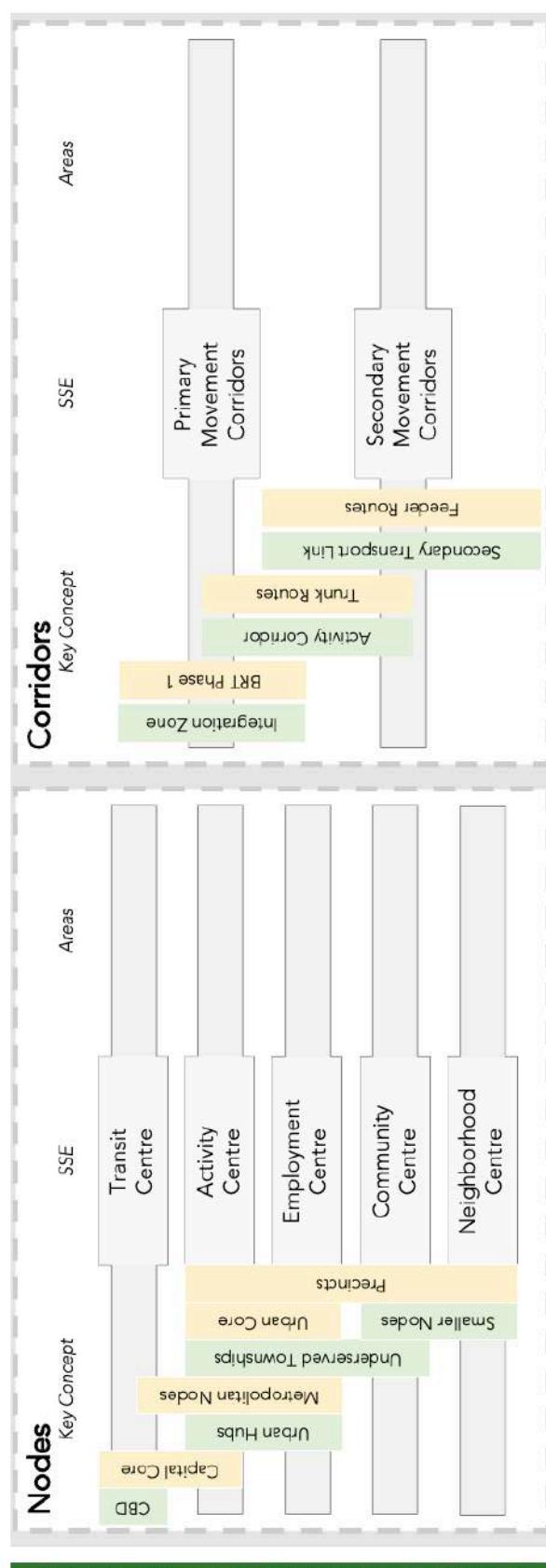
above. The proposed methodology to determine which areas are assigned to which spatial structuring element comprises of a spatially based multi-criteria assessment. This methodology is specifically suitable as it can compare various attributes of each comparable unit, often in hexagon format. The most suitable spatial structuring element, based on the criteria of each, will then be assigned to the comparable units, and then assigned to the areas associated to the said units. The MSDF has followed an evidence-based approach when identifying the city's spatial structuring elements.

8.3.1 Concept Alignment

In Chapter 8.1, a multitude of concepts used to describe and classify functional spaces in the City was described and unpacked. Even though all frameworks can be related to each other, given the focus of the BEPP, this document will specifically relate the National Treasury Urban Network Structure, and the City of Tshwane Metropolitan Spatial Development Framework to each other.

Figure 18 shows how the Urban Network Structure concepts (Green) and the Metropolitan Spatial Development Framework (Yellow) relate with respect to the fundamental spatial structuring elements. It also shows that there is no one-to-one relationship between the elements, and that some criteria or characteristics per concept relate to some fundamental spatial structuring elements exclusively.

Figure 18 Spatial Structuring Matrix: Part 3A: Spatial Structuring Elements and Concept Alignment

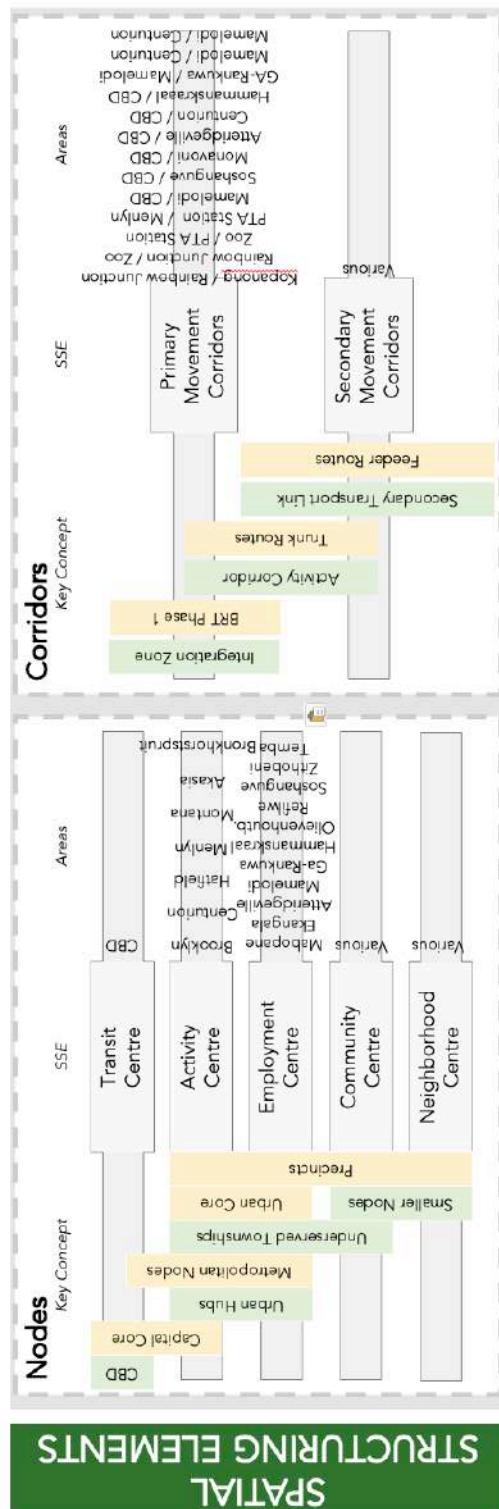


SPATIAL STRUCTURING ELEMENTS

8.3.2 Area Assignment

Figure 19 shows the relationship between the functional areas within the City, with respect to the fundamental spatial structuring elements and the key planning framework concepts put forward by the Urban Network Structure and the Metropolitan Spatial Development Framework.

Figure 19 Spatial Structuring Matrix: Part 3B: Spatial Structuring Elements and Area Assignment

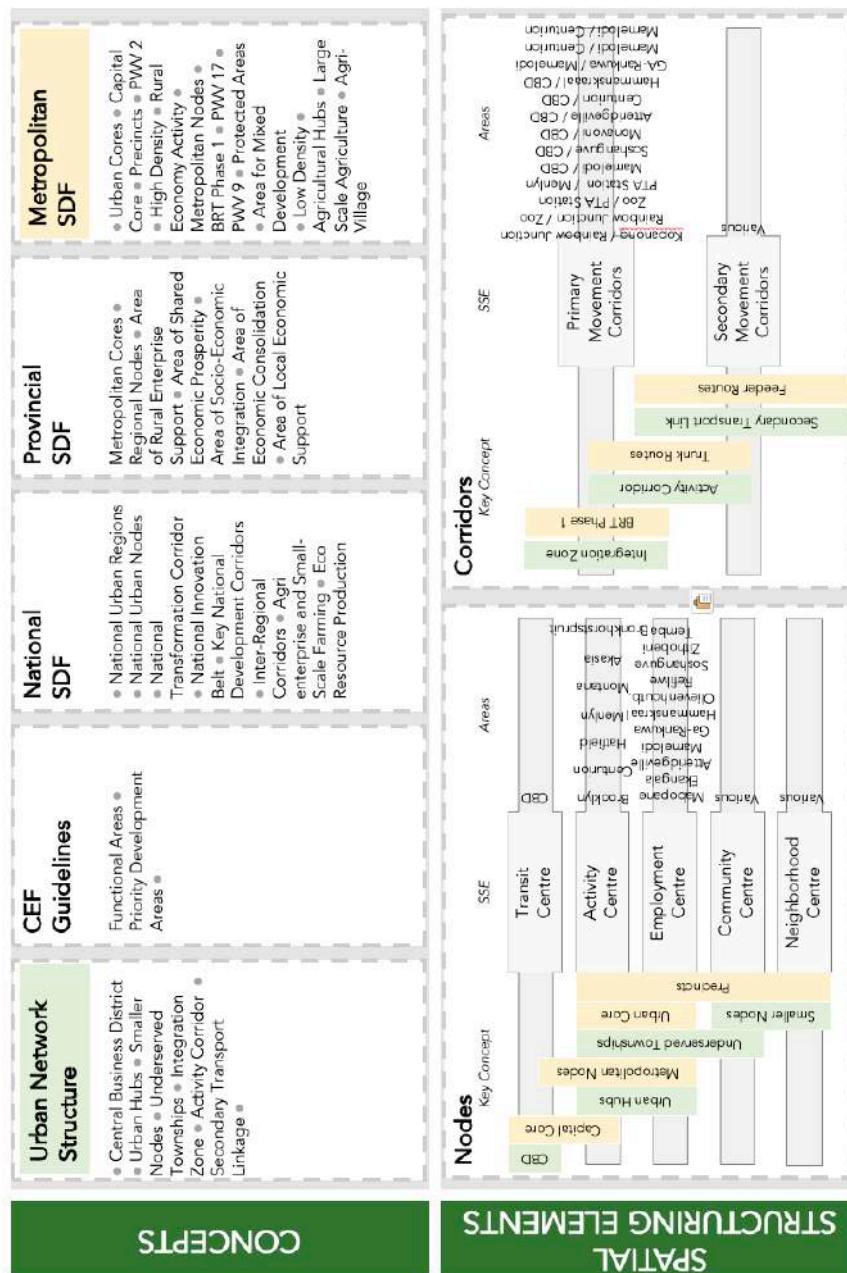


8.3.3 Spatial Structuring Matrix

Figure 20 serves as the spatial structuring matrix which applies to the City of Tshwane. The purpose of the spatial structuring matrix is as follows:

- Identify the different planning framework concepts that describe, guide and impact particular areas in the City;
- Provides a set fundamental spatial structuring element, and;
- Assign areas in the City to the fundamental spatial structuring elements and the key concepts driving investment in the City.

Figure 20 Spatial Structuring Matrix



8.4 Priority Development Areas (PDAs)

8.4.1 Identification and Delineation of PDAs

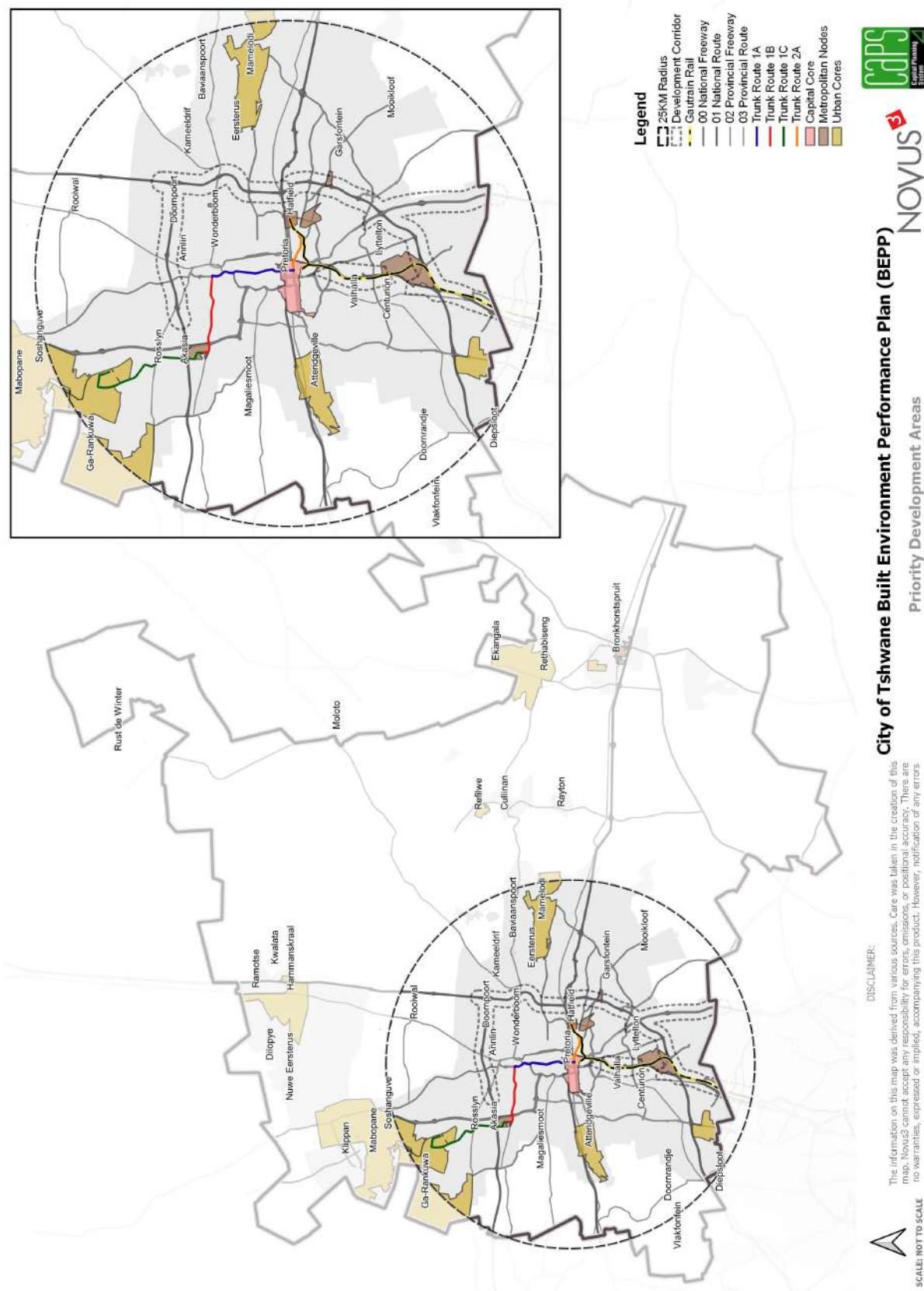
Spatial structuring elements in the City do not all carry the same importance or rank in terms of the spatial strategy and implementation timeframes. Furthermore, the City's available resources to fund capital investment interventions is limited and the capital demands associated with urban development far outstrips the available resources. The City therefore needs to identify, delineate and allocate a relative ranking or priority between the different spatial structuring elements, as part of a PDA approach, in order to achieve the following:

- Spatial restructuring;
- Economic growth;
- Sustainable development.

The PDAs of note of the City of Tshwane, based on the Spatial Structuring Matrix and its adjoining hierarchy of concepts and fundamental spatial structuring elements are defined in terms of nodes and corridors – each grouping with its own priority. These include:

- Nodes: There are three categories of nodes that are regarded as priority development areas. These include, in order of priority, the CBD (which comprise of the Pretoria Inner City), the Metropolitan Nodes (i.e. Brooklyn, Centurion, Hatfield, Akasia and Bronkhorstspruit), and the Urban Cores, otherwise referred to by the UNS as the underserviced township areas (i.e. Mabopane, Ekangala, Atteridgeville, Mamelodi, Garsfontein, Hammanskraal, Olievenhoutbosch, Refilwe, Soshanguve, Temba and Zithobeni).
- Corridors: Even though all planned activity corridors in the City can be regarded as having a high priority, it is paramount to focus on corridors where existing infrastructure implementation initiatives are being implemented. The PDA in terms of corridors specifically relate to the activity corridor already constructed or under construction, which comprise of IPTN Phase 1, with a 500m and 800m permeable walkability buffer. IPTN Phase 1 links Hatfield and the Pretoria Inner City. From the Pretoria Inner City, it links with the Pretoria Zoo from where it links northwards to Wonderboom and Rainbow Junction. This does not take away from the impetus placed on the PWV-9 project of provincial government, nor implies that the City does not recognise the potential of the PWV-9. Given the available levers of the City, and the criteria for corridors with respect to the BEPP, i.e. already constructed or under construction, the PWV-9 does not qualify in this category.

Figure 21 Priority Development Areas for the City of Tshwane



A further differentiation is developed by the City, comprising of Precincts and Integration Zones. The purpose of this differentiation is to elevate the importance of areas within the PDAs. This is done by differentiating on virtually a block level, between PDAs.

8.4.2 Precincts

The city has identified a number of precinct plans that will serve to target spatial planning interventions and capital investment within the respective regions. These precinct plans will unlock socio-economic support, economic growth opportunity and assist in developing liveable vibrant community spaces.

The list of envisioned precinct plans for the city, underwent a process of internal prioritisation to identify priority precinct plans for short-, medium- and long-term implementation. Table 9 shows the results of the precinct prioritisation process in terms of implementation priority and region, together with the actions required.

Table 9 Prioritised Precincts

Spatial Policy	Comment	Review of Existing Plan?	New Plan Required?
Region 1 – Short Term Implementation			
Pretoria North Precinct Plan	Needed urgently as a large amount of application has been received and current SDF policy is outdated.	Yes	Pretoria North Precinct Plan
Ga-Rankuwa Gateway Node precinct plan.	Needed urgently as a large amount of application has been received and current SDF policy is outdated.	Yes	
Tshwane Automotive City (TAC) Precinct Plan	Medium Term priority and normally work is being completed and it also ongoing.		Yes
Region 1 – Medium Term Implementation			
Mabopane Station / Soshanguve station Precinct plan	Medium Term priority and normally work is being completed and it also ongoing.	Yes	
Region 1 – Long Term Implementation			
Development Guidelines and access management along Activity Spines and Streets in the Soshanguve Areas.	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 1B & C. Exact route and station locations are needed.		Yes
Spatial Development Framework for the Akasia Metropolitan Core.	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 1B & C. Exact route and station locations are needed.		Yes
Spatial Development Framework / Urban Design Framework for BRT Line 1 B & C.	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 1B & C. Exact route and station locations are needed.		Yes

Spatial Policy	Comment	Review of Existing Plan?	New Plan Required?
Region 2 – Short Term Implementation			
Wonderboom Airport Precinct Plan			Yes
Tshwane Freight and Logistic Hub Precinct Plan			Yes
Region 2 – Medium Term Implementation			
Onderstepoort and Haakdoornboom Precinct Plan		Yes	
Rainbow Junction Development Node Precinct Plan		Yes	
Hammanskraal CBD Precinct Plan		Yes	
Region 3 – Short Term Implementation			
Hatfield Urban Design Framework for public space and streets.	Work has started. The University of Pretoria have appointed consultants to do Hatfield Urban Design Framework for public space and streets.		
Spatial Development Framework / Urban Design Framework for BRT Line 1 A.	Draft Framework has been approved by Council for public participation purposes.		Yes
Spatial Development Framework / Urban Design Framework for BRT Line 2 A.	Draft Framework has been approved by Council for public participation purposes.		Yes
Hazelwood Node Urban Design Framework for public space and streets.	Work has started by private sector. Line 1A is operational and needs a plan.		
Salvokop Urban Design Framework	The work has been done by the Private sector.		
Region 3 – Medium Term Implementation			
Spatial Development Framework / Urban Design Framework for BRT Line 2 B.	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 2 B. Exact route and station locations are needed.		Yes
Lotus Gardens and Fort West Precinct Plan	Can only commence with plan / framework once detail design has been finalized in terms of BRT for the west. Exact route and station locations are needed		Yes
Marabastad and West Capital Precinct	The Precinct is experiencing some development especially the social housing and urban management pressure		Yes
Koedoespoort Industrial Area Management			Yes
Eugene Marais Hospital Precinct			Yes
Region 3 – Long Term Implementation			

Spatial Policy	Comment	Review of Existing Plan?	New Plan Required?
A precinct plan for the Council property in Menlo Park/Ashlea Gardens on 26th street.	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 2 B. Exact route and station locations are needed. Project should be done Property Management section.		
Arcadia North, Eastclyfe, Eastwood, Kilberry and Lisdogan Park	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 2 B. Exact route and station locations are needed.		Yes
Region 4 – Short Term Implementation			
Precinct Plan for Gautrain Station (Centurion/ West Avenue).	Needed urgently as a large number of applications have been received and current SDF policy is outdated. Growth Point prepare to pay for the upgrade in West Avenue in association with Tshwane Engineering Departments.	No	Yes
Urban Design Framework and Infrastructure Management Framework for the Centurion Metropolitan Core.	Needed urgently. The construction of the terminus not in line with previous plan will have a profound influence in the development of the rest of the development envelop of the precinct. New plan should give direction to the development of the rest of the precinct to include the future development of the International Convention centre and rest of mixed-use land uses in terms of the BCX agreement.	Yes	Yes
Region 4 – Medium Term Implementation			
Urban Design Framework and Infrastructure Management Framework Monavoni Nodal Area (extension to Lanseria Regional Spatial Policy above).		Yes	
Urban Design Framework and Infrastructure Management Framework for the Kosmosdal/ Samrand/ Olievenhoutbos area.		Yes	
Urban Design Framework and Infrastructure Management Framework and Road infrastructure plan for the Raslouw AH		Yes	
Region 4 – Long Term Implementation			
Precint plan for the provision of services and guideline for			Yes

Spatial Policy	Comment	Review of Existing Plan?	New Plan Required?
development in green area for the eastern boundary outside of the urban edge where rapid development associated with the Lanseria Regional Spatial Policy, currently being drafted by Gauteng			
Region 5 – Short Term Implementation			
Derdepoort area TAC Precinct			Yes
Refilwe-Cullinan Tourism Precinct and Rayton-Cullinan Tourism Precinct			Yes
Gem Valley, Glenway and Leeuwfontein area			Yes
Region 6 – Medium Term Implementation			
Spatial Development Framework / Urban Design Framework for BRT Line 2 C and D.		Yes	
Denneboom and Surrounding Precinct Plan		Yes	
Greater Mamelodi Transitional zones (Train station) Precinct plans			Yes
Max City and Surround Precinct.			Yes
Mooiplaats Area Precinct. For areas within the Urban Edge currently under mixed use development pressure.			Yes
Region 6 – Long Term Implementation			
Menlyn Node Urban Design Framework for public space and streets.	Can only commence with plan / framework once detail design has been finalized in terms of BRT Line 2C. Exact route and station locations are needed. Project should be done Property Management section.		
Region 7 – Short Term Implementation			
Sokhulumi Agri-village	The area does not have a plan guiding spatial planning and land use management. This area only depends on the Agri-village concept to guide land use.		Yes
Region 7 – Medium Term Implementation			

Spatial Policy	Comment	Review of Existing Plan?	New Plan Required?
Ekangala Area	<p>There is an application for a proposed mall in the area which has not been finalise.</p> <p>This will be a catalyst for other developments.</p>		Yes
Region 7 – Long Term Implementation			
Zithobeni Area			Yes

8.4.3 Integration Zones

Based on the Spatial Structuring Matrix, it is clear that the concept “Integration Zone” originates from the Urban Network Structure as defined by National Treasury. Considering that this document, the BEPP for 2020/21, serves to report on the UNS, particular focus will be given to the Integration Zone within the City of Tshwane.

8.4.3.1 Definition

The definition of an integration zone, as per the Urban Network Structure, are defined as:

The Urban Network consists of a number of Integration Zones. Each zone is a part of a city or city region-wide TOD network. An integration zone is a spatial planning element facilitating spatial targeting of investment aimed at spatial transformation. Each zone consists of a transit spine connecting two anchors via mass public transport (rail/bus), e.g. the CBD and an “urban hub” (township node with the best investment potential). It can also comprise of the CBD and another primary metropolitan business node. Between the two Integration Zone anchors are a limited number of Integration Zone intermediate nodes that are strategically located at key intersections connecting to marginalised residential areas (townships and informal settlements) and economic nodes (commercial and industrial nodes) via feeder routes. The Urban Hub connects to secondary townships nodes within the marginalised peripheral township. The Integration Zone includes a hierarchy of TOD precincts located and prioritised within the structure of nodes described above.

From the definition above, it is clear that an integration zone is the proverbial “string”, in the “beads on a string” concept. The basic elements necessary to define an integration zone are therefore as follow:

- Transit spine;
- Nodal anchors;
- Intermediate nodes / precincts, that intersect with feeder routes.

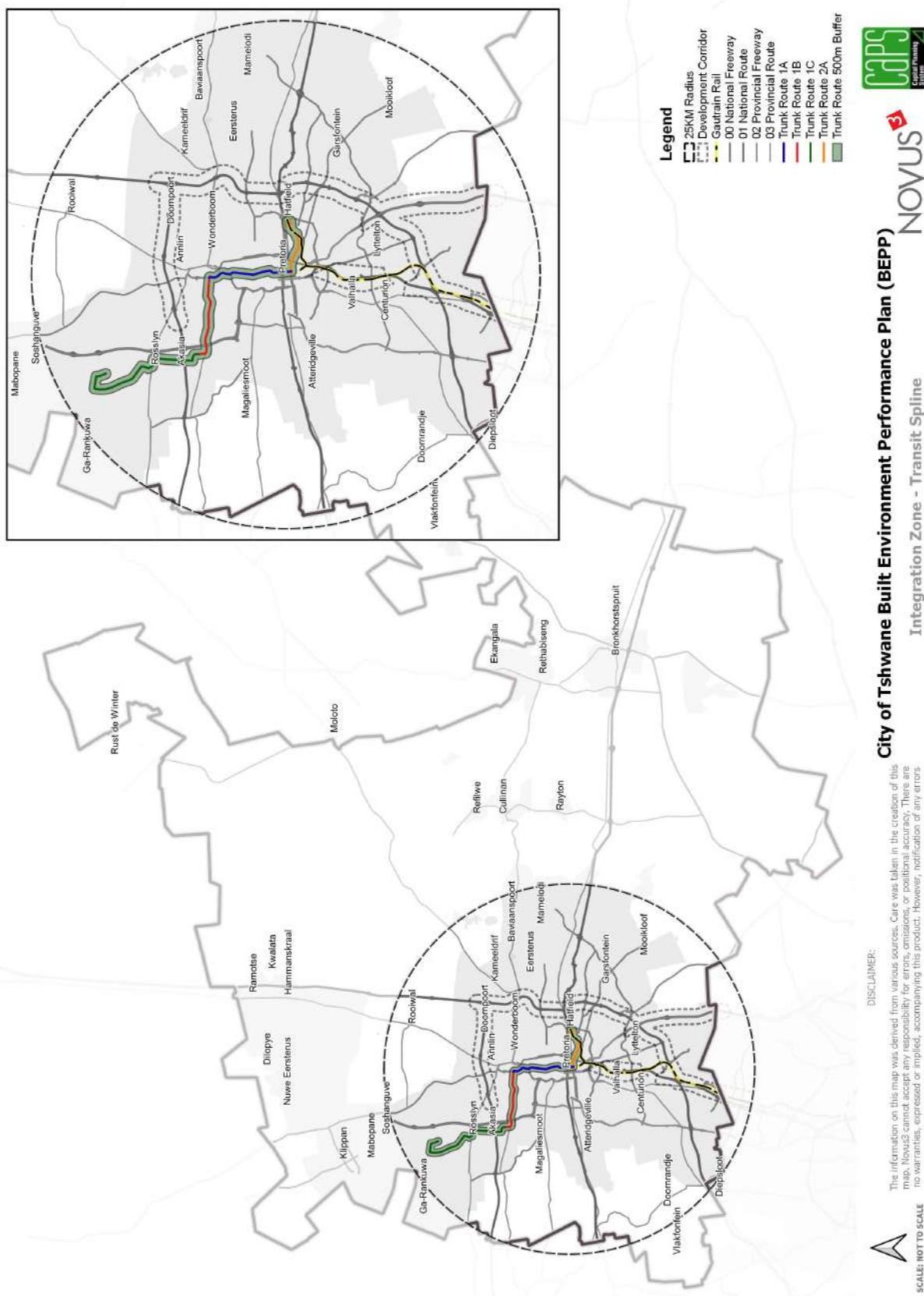
8.4.3.2 Transit Spines

From the latest approved IPTN operations plan (2014), it is clear that several transit spines have been identified in the City. However, to date, not all of the transport spines have been constructed – and given the current rate of funding and implementation progress it must be assumed that the majority of the transport spines will not be constructed in the medium term. The City will therefore only focus on transit spines that are already constructed, namely:

- Line 1 A Trunk Route (From Kopanong to Rainbow Junction);

-
- Line 1 B Trunk Route (From Rainbow Junction to the Zoo);
 - Line 1 C Trunk Route (From the Zoo to Pretoria Station), and;
 - Line 2A Trunk Route (The Pretoria Station to Menlyn).

Figure 22 Integration Zone – Transit Spine

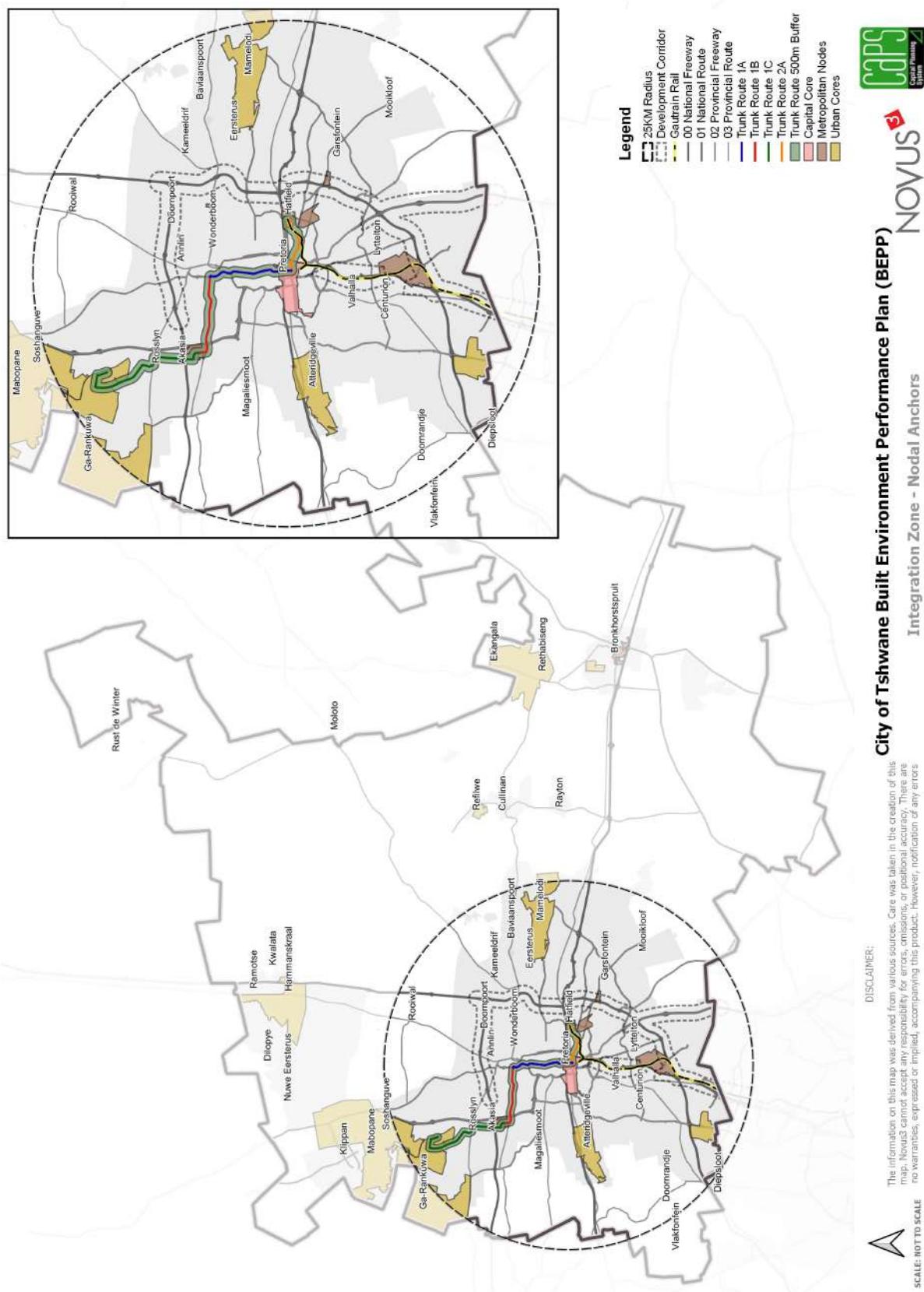


8.4.3.3 Nodal anchors

From the MSDF there are several nodal anchors within the City. With respect to the identified transit spine, the nodal anchors that comprise the transit spine, will be considered to help define the integration zone. These include:

- Capital Core (which comprise of the Pretoria Inner City);
- Metropolitan Nodes (Akasia and Hatfield), and;
- Urban Core Nodes (Ga-Rankuwa, and Soshanguve / Mabopane to the north).

Figure 23 Integration Zone – Nodal Anchors



8.4.3.4 Feeder routes and accessibility

From the identified transit spine, the operations plan, and the nodal anchors, the second last test to verify the Integration Zone, is to identify the feeder routes intersecting with the transit spine as well as the accessibility with respect to the transit spine. Accessibility will be defined by a 500m and 800m buffer zone, based on walkable permeable network analysis.

Figure 24 Integration Zone – Feeder routes & accessibility



8.4.3.5 Integration Zone Precincts

The final assessment of the Integration Zone is to define the “beads” (precincts) that are aligned to the “string” (transit spine). Considering the context and definition of an Integration Zone, as well as the spatial form driven by the City, the City has recognised the following precincts:

- Tshwane Automotive City (TAC) (Rosslyn) Precinct;
- Tshwane freight and Logistics Hub (Akasia) Precinct;
- BRT Line 2 Urban Design Framework;
- West Capital Precinct;
- Northern Gateway Precinct;
- Salvokop Precinct, and;
- Hatfield Precinct.

The Rosslyn Precinct extends over the boundaries defined by the previous mentioned parameters. Its impact on the spatial form of the City can justify the consideration to expedite the medium-term plans regarding IPTN expansion, due to potential housing expansion and industrial / commercial development in the precinct.

The Northern Gateway Precinct, West Capital Precinct and Salvokop Precinct forms part of the Tshwane Inner City Regeneration Strategy (TICRS) and is the most progresses three (3) precincts of the seven (7) key precincts within the Inner City. The TICRS aims to achieve amongst others the key outcomes as intended by the Integration Zone definition and can be further related to the housing and transport alignment of the City. The TICRS has been drafted and approved as the strategy to move all National Government departments into the City, specifically in the two Government Boulevards and Civic Precinct – creating areas of economic growth; and to significantly increase the housing densities in West Capital and the Nelson Mandela Development Corridor – creating areas of residency.

Figure 25 Conceptual Integration Zone – Transit Spine, Nodal Anchors and Precincts

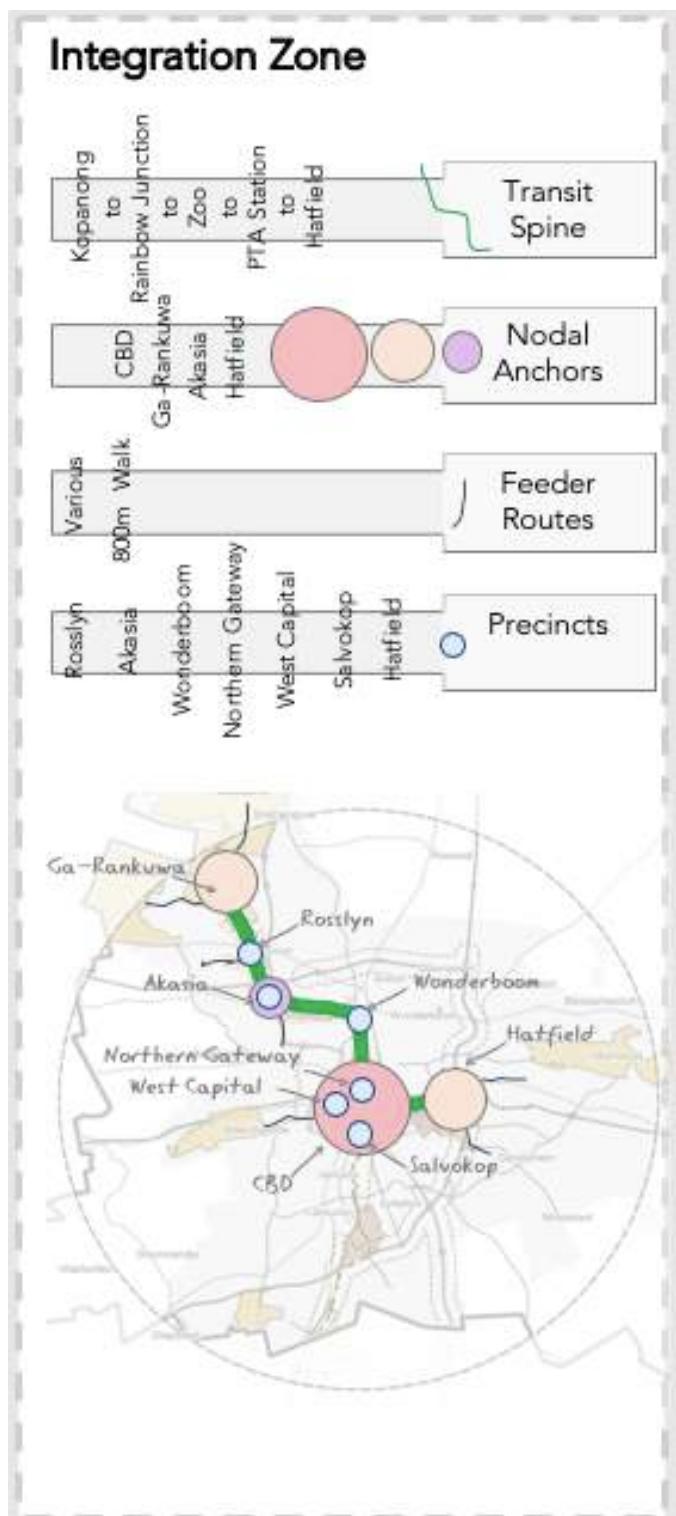
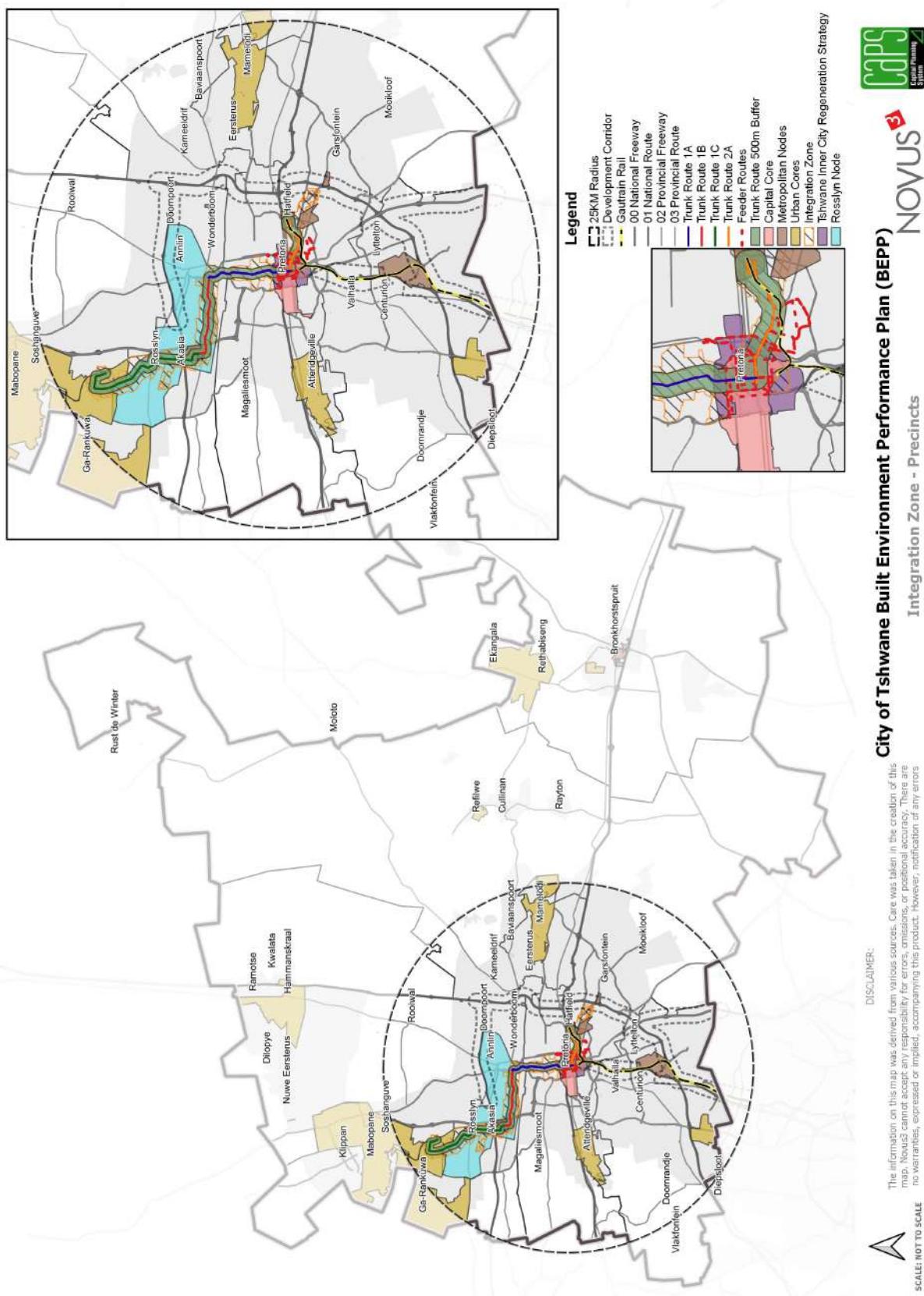


Figure 26 Detailed Integration Zone – Transit Spine, Nodal Anchors and Precincts



9 Human Settlement and Transport Planning Alignment

The alignment of human settlement (housing) and transport planning and investment initiatives within the City is not only of importance from a BEPP reporting perspective, but also from an socio-economic transformation, space utilisation and optimisation, and financial efficiency and sustainability perspective.

National Treasury is particular focussed on the effective alignment between human settlement and transport planning and investment initiatives given the magnitude of national, provincial and municipal funds allocated to the two disciplines. Furthermore, housing and transport relate to the most elementary drivers of our economy, and if implemented correctly, will lead to economic growth, socio-economic upliftment, improvement in the space economy towards more productive cities etc.

It is therefore important to investigate and emphasise the alignment between housing and transport, as it is the premise that once the housing and transport arrangement in a city is efficient, several other efficiencies will be activated related to, but not limited to property value, public space utilisation, revenue collection on public transport systems, etc. which all in turn lead to more public funds – through successful revenue collection – and so better service delivery. The same efficiencies should aim to provide a myriad of housing options, which in turn will address the massive housing backlog in South Africa.

9.1 Alignment Rationale

Research by the Centre of Affordable Housing Finance in Africa (CAHF) demonstrates that South Africa's housing sector is not performing to expectations. The sector fails to deliver affordable housing options at the rate and scale needed and it does not provide accessible options close to employment opportunities.

While the government's focus is necessarily on the destitute, CAHF concludes that a wider segment of the population is unable to meet its housing need. The main challenge in the availability of affordable housing options aimed at the subsidy-eligible market, as well as the so-called gap market-households that earn between R3500 and R10 000 per month. 46,9% of total households earn less than R3500 per month. This cohort qualifies for RDP housing located on the periphery of the city and is dependent on taxi and bus transport.

There is a need for an active housing market at the bottom end of the housing sector. Otherwise put, a market that motivates the informal dweller to migrate to an RDP house; the RDP owner to move into the bonded houses; and the bonded owner to migrate to a higher value house. At present, the owners are locked into their current houses located on the periphery of the city. A major cause of the present scenario is insufficient supply to meet the demand located in close proximity to employment opportunities.

The major challenge to be resolved with regard to the City's urban structure, is to reduce the distance between home and work. With the apartheid laws being abandoned in the early 1990's and this all restrictions now non-existent, affordability determines housing and location decisions.

The department of Human Settlements' Strategic Plan 2015-2020 outlines measures for establishing viable and socially and economically integrated communities that are situated in areas that allow convenient access to economic opportunities.

Up to date, the City has focussed on informal settlement eradication as guided by the National Human Settlements Program. Key drivers of this program were based on where people are located, land

ownership, and property value. The latter being one of the most prohibitive forces of aligning housing with transport initiatives.

The prohibitive costs of strategically located land requires that government takes a more prudent approach to acquiring (and retaining) land for human settlements. Assessing the full extent of the City's assets in terms of land and buildings, coupled with under-utilised state-owned land and assets are a practical way of accruing such strategic land.

Land banking, within this context, is the practice of aggregating and/or setting aside parcels of land for future strategic use. The City is currently updating its Asset Register. As part of the process, all municipal-owned land and buildings that have potential to contribute towards sustainable human settlements and other strategic objectives of the City, should be flagged.

In 2019, Tshwane updated and approved a new land release strategy. The report recognises the on one hand, there are arguments put forward that public land must be preserved for future generations while on the other, the idea that municipalities should recognise the potential of the transfer of municipal property assets or the granting of lease rights with a view to inject much needed revenue and/or investment in targeted areas, is also gaining traction. It is therefore important that the City finds and manages the delicate balance between these two competing views and the process to be followed in implementing either of them.

9.2 Alignment Perspective

Compaction and densification are two of the cities key focus areas when it comes to urban development in relation to housing and transport integration. The following section will therefore provide more insights into the compaction and densification processes within the City's Integration Zone, with specific reference to the alignment of investment initiatives of housing and transport.

9.2.1 Compaction

Compaction, in the context of urban development and the MSDF, refers to intensification of land use which promotes relatively high residential density with mixed land uses and is based on an efficient public transport system which encourages walking, cycling as well as low energy consumption modes of transport. It also refers to the provision of large-scale opportunities for social interaction, which suggests the provision of social facilities and a public realm.

To evaluate the alignment between housing and transport, within the City's Integration Zone, the following indicators for compaction will be discussed:

- Modes of transport;
- Bid-rent model, and;
- Public realm.

9.2.1.1 Modes of Transport

Modes of transport refers to options for travelling. The more modes of transport accessible within an area, the less users are captive market participants, which implies a less constrained economy in the area. More modes of transport also allow for inter-modal transfer, which enables users of the area to move from place of residence to place of employment efficiently across a wide range of transport modes.

The IPTN Operational Plan of the City's BRT recognises the interaction between different modes of transport and incorporate and integrate the different modes of transport along the activity spines in the City. The higher the number of modes of transport, and the higher the finer the urban grain, the more potential passenger trips between places of residence and places of economic activity per hour are possible.

With respect to the different modes of transport within the Integration Zone, it is clear from the Operational Plan that the City is making provision for a variety of modes of transport, albeit public or private, vehicular or non-motorised.

Figure 27 Median station with bypass lane



Figure 28 Side Stop with dual carriage way



9.2.1.2 Bid-Rent Model

Based on the fundamental principles of the Bid-Rent model, the higher the ratio between density of land uses and distance to the city centre, the higher the prices. Different price elasticities exist per land use types, however the relationship between density, distance and the city centre remain the same; as dictated by market forces.

The ability to do business, find employment, access economic or commercial opportunities are directly correlated to the number of land-uses within a specific area. The potential for economic prosperity and growth is therefore expressed in terms of property value. The higher the rate paid per hectare, the more efficient the land utilisation will be. It is for this reason that property value is a good proxy for compaction identification.

The City has completed a land value audit in 2020 to better understand the land value trends within the City, and to give insights on which areas are most valuable. This study was not yet defined in terms of the integration zone and can therefore not be unpacked in this section.

9.2.1.3 Public Realm

The public realm indicator of compaction relates to the number of public facilities and amenities within an area. The more facilities or amenities in close proximity to each other, the more compact that space becomes, which makes it even more attractive as a travel destination; and so increasing passenger trips per hour to that destination. This follows the logic purported by the bid-rent model.

9.2.2 Densification

Densification in the context of urban development and the MSDF, refers to increasing residential density in a planned and meaningful way within the existing boundaries of specific areas to meet efficiencies in infrastructure, service and amenity provision. To evaluate the alignment between housing and transport, within the Integration Zone, the following elements for densification will be discussed:

- MSDF densities – desired densities;
- Current zoning densities – current potential densities;
- IPTN land use assessment – Development potential, and;
- Density determinants.

9.2.2.1 MSDF Densities – Desired densities

The MSDF serves as the spatial strategy for the City. It provides the guideline of the density targets to be achieved within the integration zone. The MSDF sets the following density targets along the integration zone:

- 0m to 500m walking distance from the Transit Spine: 200 dwelling units per hectare
- 501m to 800m walking distance from the Transit Spine: 120 dwelling units per hectare
- Adjacent to feeder routes: 80 dwelling units per hectare

From the city's perspective, it would be ideal to increase the densities of residential use, that are closest to the activity or transit spine. This correlates with the bid-rent model theory, whereby it is more efficient to occupy land closest to the services that lends itself to provide the ability to travel, i.e. reach areas of economic potential. The city understands the benefit of densifying development, and specifically residential development within a walking distance to the IPTN in the integration zone.

The tapering down of densities imply a reciprocal tapering down in the level of service provided in terms of public transport along the integration zones. A density of 80 dwelling units per hectare represent a lower number of passengers per trip per vehicle, which imply to optimise the service

offered a lower level of frequency between the feeder pick-up points and the integration zone itself should be implemented.

A density of 200 dwelling units per hectare, represents a higher passenger per trip per vehicle, which implies the affordability to operate at higher frequencies, which in turn implies higher potential to access opportunities. Therefore, the higher the density in the integration zone closest to the activity spine, the higher the possibility to access jobs, the higher the potential for other land uses to attempt to occupy the same space. This in turn increase land value, which makes it more difficult for public sector to occupy the space required for spatial restructuring.

From a housing provision perspective, much of the area within the Integration Zone is already developed, therefore it is difficult to compete for development space with the private sector in a competitive brownfields development area. Given the potential along a public transport route, this competition is even more pronounced than other areas of the City. The City is therefore required to provide more corrective and framework related measures, that result in inclusionary housing, housing typology management and land release strategies that will enable the City to compete efficiently for housing development within the Integration Zone.

The fine balance between density, property value, and infrastructure provision calls for dedicated guidance from the City, and is provided in the MSDF, RSDF and Town Planning Scheme from a regulation point of view. The next step is to develop an incentive strategy through the newly established policy development division within the department of human settlements.

9.2.2.2 Current zoning densities – current potential densities

Zoning is the process of dividing land in a municipality into zones in which certain land uses are permitted or prohibited. In addition, the size, bulk and placement of buildings are regulated in order to manage amongst others, the infrastructure burden on the limited resources of the municipality. Zoning implies services that are already available. It also implies building controls applicable to each erf. Building controls are one the instrument the City can use to ensure the desired urban form, and density are achieved.

When evaluating the alignment between housing and transport, the expectation is that the zoning along the activity or transit spine, and within the Integration Zone, are of such a nature that it firstly corresponds to the MSDF, and secondly indicate what the municipality want to achieve with a piece of land. The difference between the desired densities and the actual land use, indicates the following:

- The ability to develop in greenfields areas;
- The ability to develop in brownfields areas;
- The potential upgrading, and so, occupancy potential increase;
- The potential services that needs to be provided should development occur, and;
- The market's certainty and alignment with what the municipality attempt to achieve.

Figure 29 Integration Zone: Potential land use (Part 1)

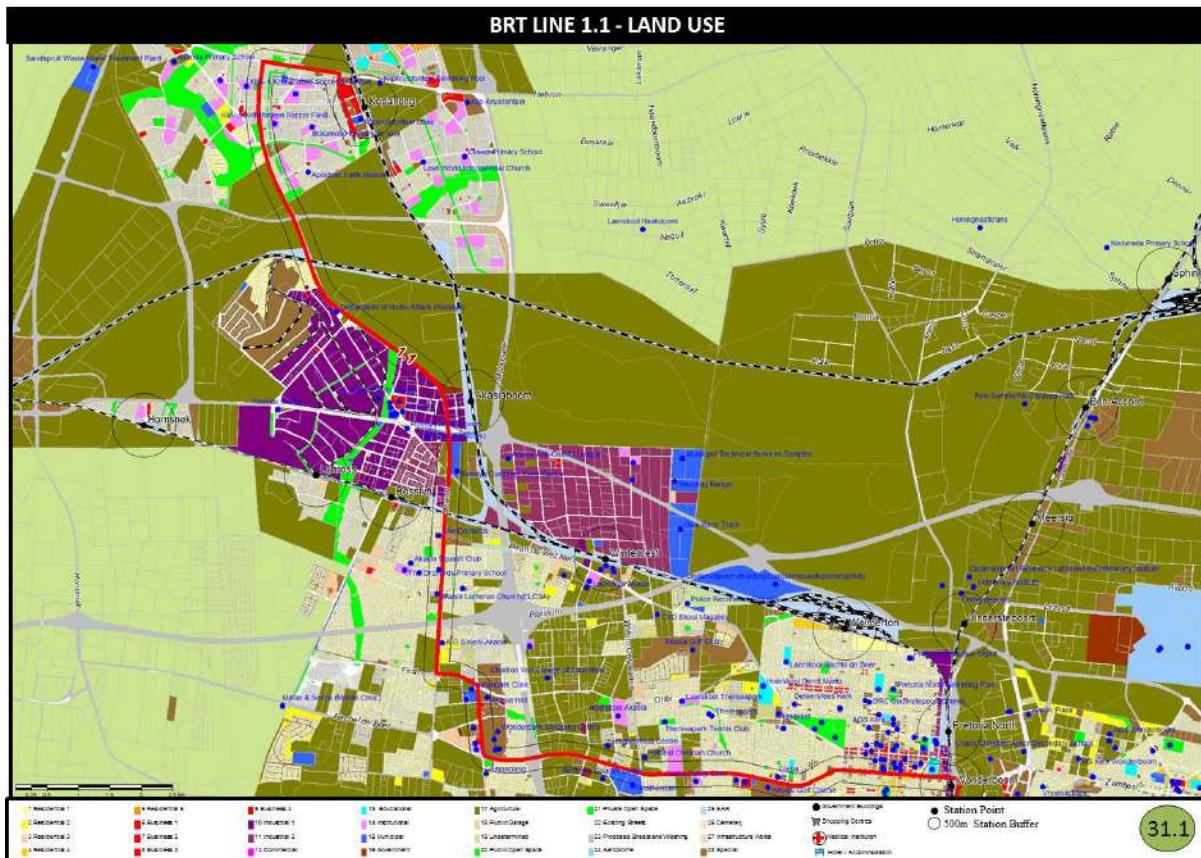


Figure 30 Integration Zone: Potential land use (Part 2)

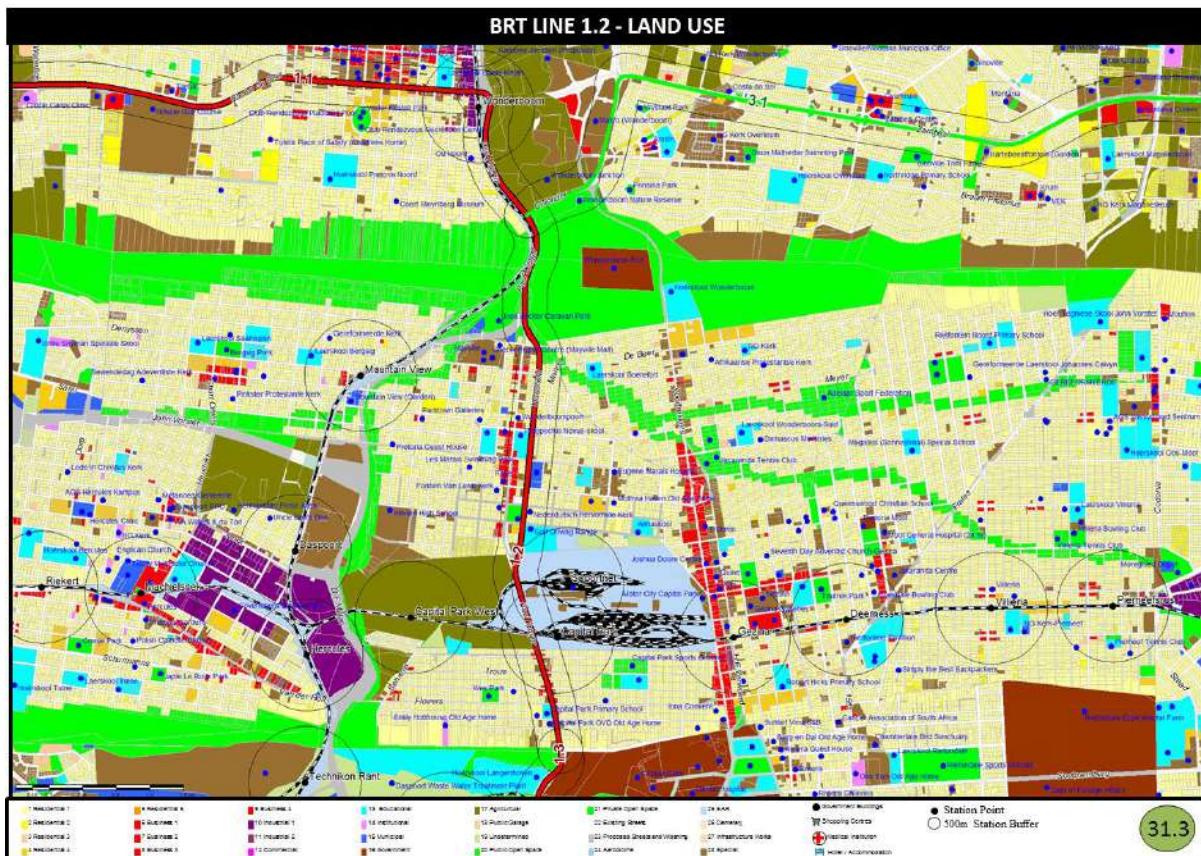
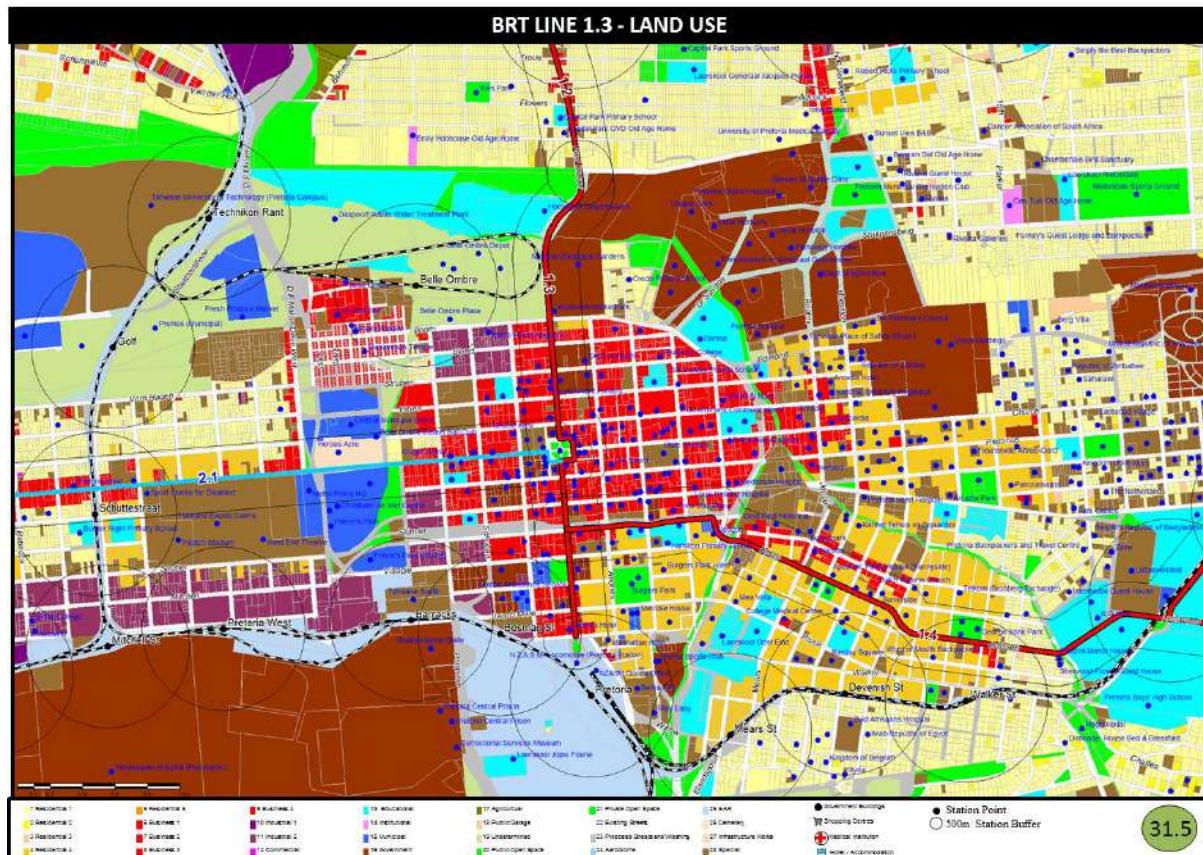


Figure 31 Integration Zone: Potential land use (Part 3)



Currently, the land use proportion of the integration zone (line 1) are as follow:

Table 10 land use proportion of the integration zone

IRPTN NETWORK	NON-RESIDENTIAL					RESIDENTIAL					TOTAL
	Business - Greenfields	Industrial - Greenfields	Mixed Use - Greenfields	Mixed Use - Redevelopment	TOTAL	Greenfields	Redevelopment	Densification	TOTAL		
Rail	67	156	72	57	352	749	818	48	1615	1967	
Line 1	18	12	7	1	38	330	267	159	757	795	
Line 2	0	14	0	0	14	35	11	19	64	78	
Line 3	4	6	0	10	19	104	109	0	214	233	
Line 4 Original	7	88	11	26	132	211	108	171	491	622	
Line 4 Alternative	7	103	11	26	146	161	189	425	774	921	
Links	0	0	0	0	0	1	1	105	106	106	
TOTAL Original	95	275	90	94	555	1430	1313	502	3246	3801	
TOTAL Alternative	95	290	90	94	570	1380	1394	755	3530	4099	
%	17%	50%	16%	17%	100%	44%	40%	15%	100%		
%						15%				85%	100%

Quantum related to the integration zone are part of Line 1. Yield related to the Integration Zone, Transit Spine, can be summarised as Rainbow Junction / Zoo, Zoo/PTA Station, and a part of Paul Kruger to Menlyn. This approximates 15% of the total line 1's developable land, which translates into 2,7ha Business Greenfields, 1,8ha Industrial Greenfields, 1ha Mixed Used Greenfields, and 0,15ha Mixed redevelopment.

9.2.2.3 IPTN land use assessment – Development Potential

Based on the IPTN operations plan, the estimated potential development yield in the Integration Zone is shown in Table 11 below.

Table 11 IPTN Land use assessment – Development Potential

Line 1: Sections	LINE 1: LAND IDENTIFIED FOR DEVELOPMENT ALONG THE ROUTE (200 m on both sides)										Density du/ha	
	Developable Area ha	Residential Area ha	Residential Area			TOTAL	Residential Units			TOTAL		
			High Income %	Middle Income %	Low Income %		High Income	Middle Income	Low Income			
1.1 Kopanong -Rainbow Junction	434	363	10%	10%	80%	100%	2 902	2 902	23 216	29 020	54%	
1.2 Rainbow Junction-Zoo	55	55	10%	33%	57%	100%	436	1 449	2 475	4 360	8%	
1.3 Zoo-Pta Station	5	5	20%	50%	30%	100%	82	204	122	408	1%	
1.4 Paul Kruger-Menlyn	103	103	60%	30%	10%	100%	4 934	2 467	822	8 224	15%	
1.5 Menlyn-Mahube Valley	161	144	40%	22%	39%	100%	4 556	2 512	4 431	11 499	21%	
TOTAL	757	669	24%	18%	58%	100%	12 910	9 534	31 067	53 511	80	

The results for Line 1 (sections 1.1 to 1.5) are summarised. The total residential yield along Line 1 is estimated at approximately 53 511 units. This translates to approximately 31 067 low income units, 9 534 units earmarked for middle income, and approximately 12 910 units for the high-income group.

Yield related to the Integration Zone, Transit Spine, can be summarised as Rainbow Junction / Zoo, Zoo/PTA Station, and a part of Paul Kruger to Menlyn. This approximates 38% of the expected yield, resulting in 20 344 units.

In terms of individual sections, it is evident that section 1.1 from Kopanong to Rainbow Junction provides the highest yield with approximately 29 020 units (of which the vast majority (more than 80%) is earmarked for the low-income group).

Figure 32 IPTN Land use assessment – Development Potential (part 1)

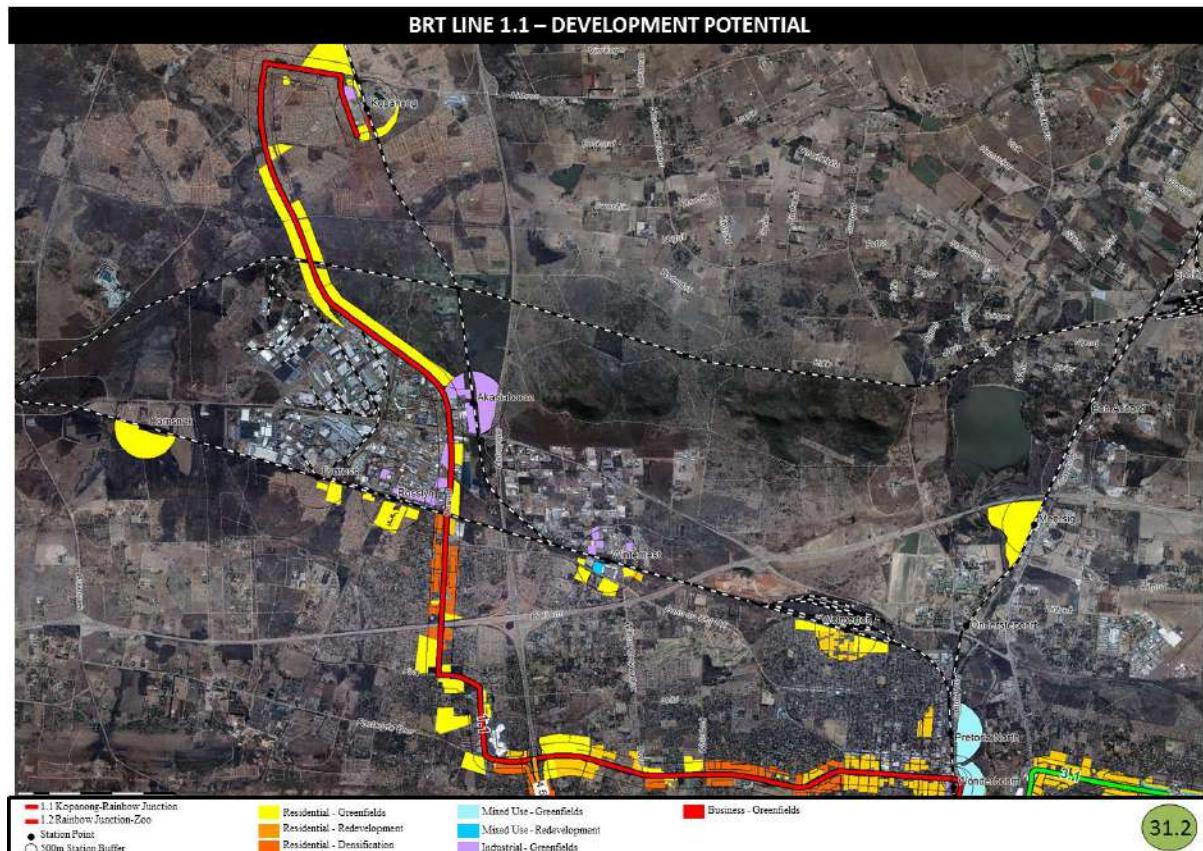


Figure 33 IPTN Land use assessment – Development Potential (part 2)

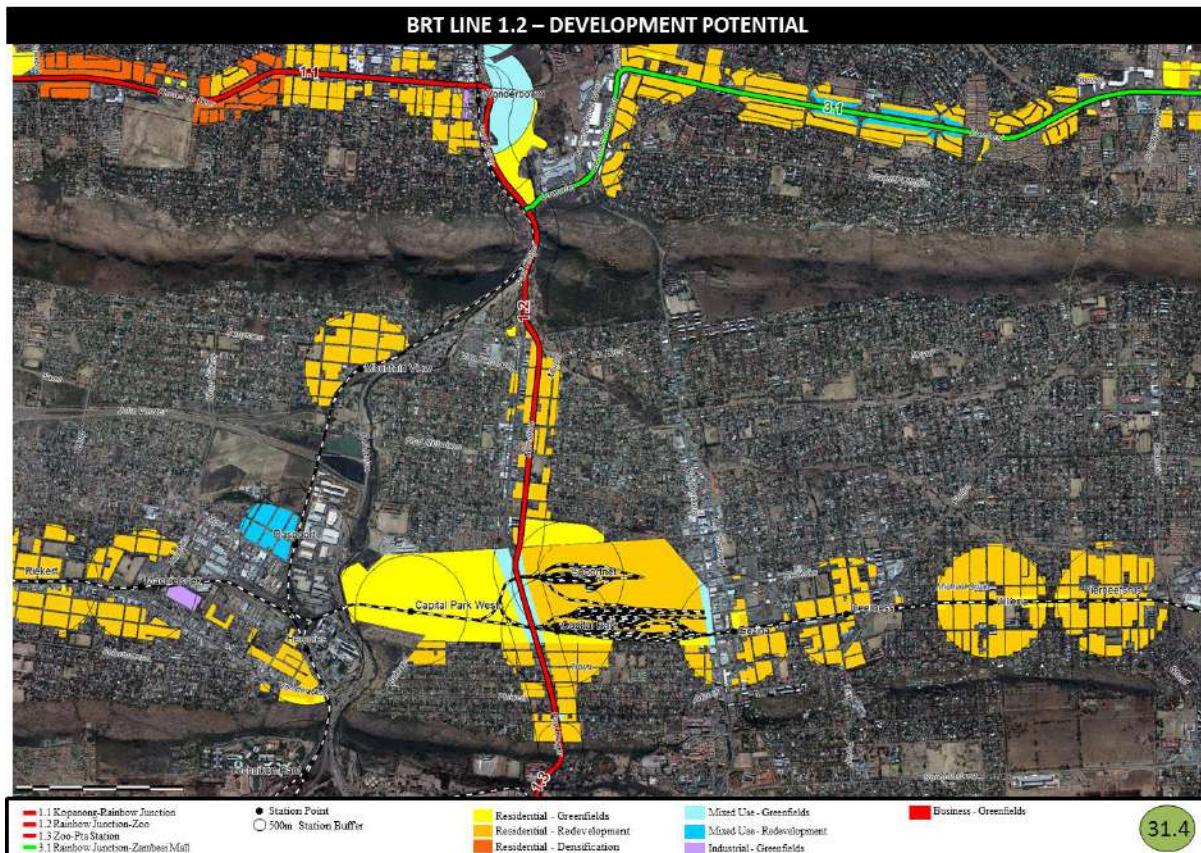


Figure 34 IPTN Land use assessment – Development Potential (part 3)

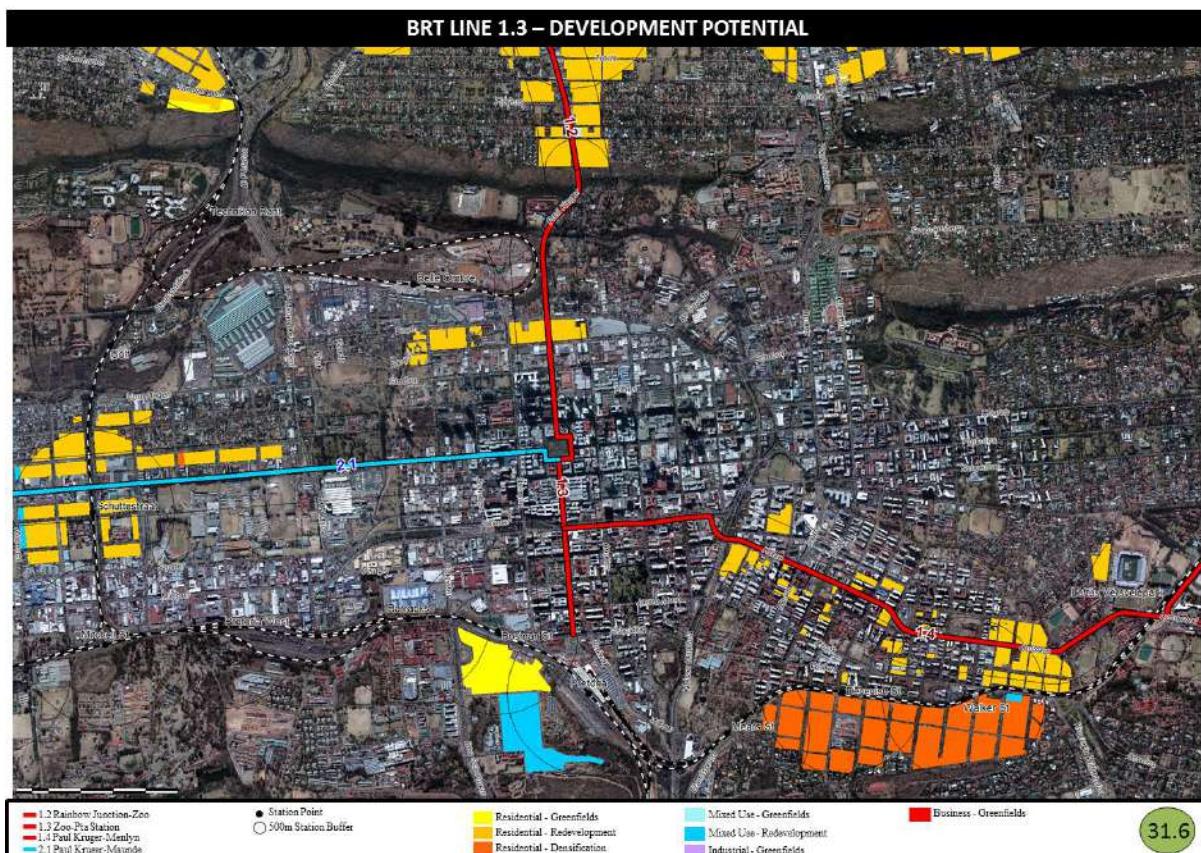
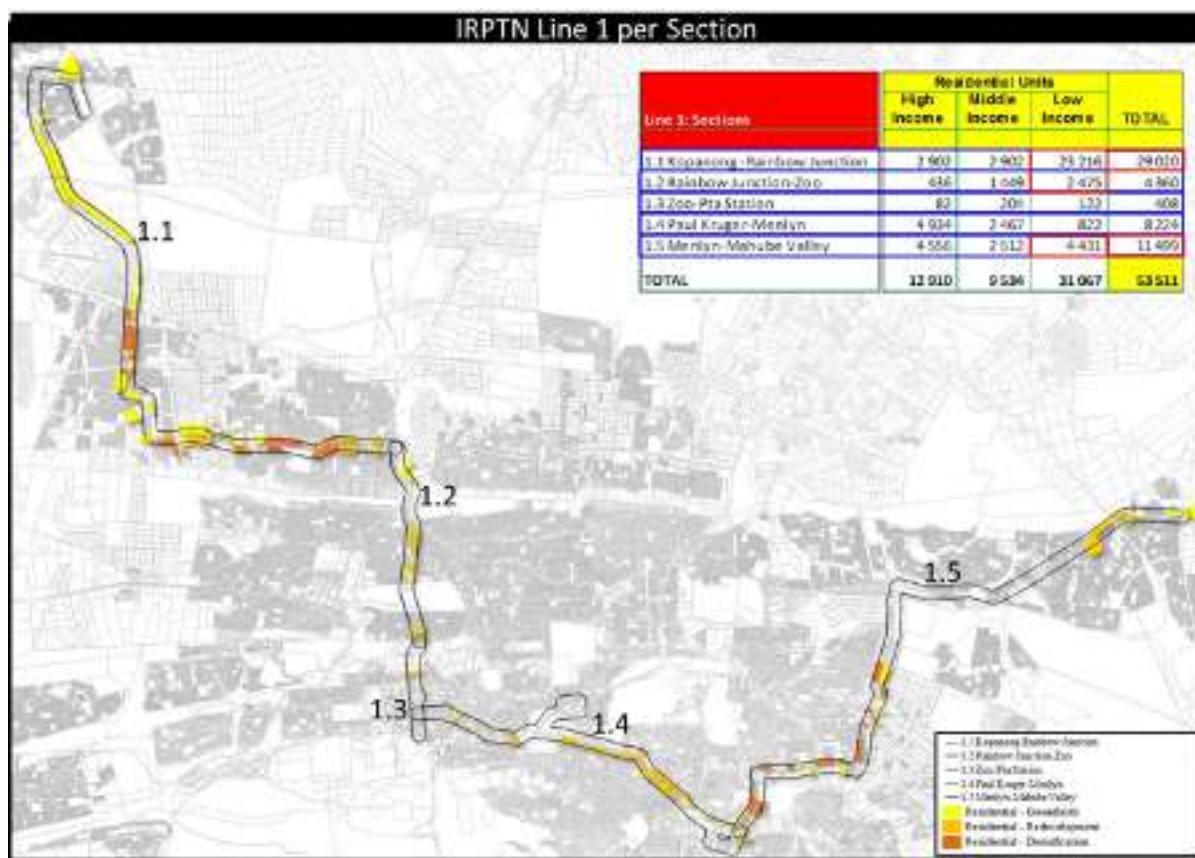


Figure 35 IPTN Land use assessment – Development Potential



10 Climate Change Risk and Impact Assessment

Climate change and consequent global warming has adverse impacts on a region's climate system which could lead to a number of potential catastrophic events including flooding, drought, air pollution, heat stress and water scarcity. Urbanised cities together with densely populated areas are areas of high risk due to the impact that these events could have on the built environment such as roads, water networks, human settlements and social infrastructure.

Given that the city is characterised by continued urban growth and consequent population pressures, measures of climate responsiveness and resilience should form part of the city' strategies to achieve a sustainable and compact city structure. The following section has been structured into three (3) parts:

- The first section outlines the results of the vulnerability assessment in line with the adaptation programme within the City Sustainability Unit (CSU),
- The second section discusses the City of Tshwane energy futures report in line with the mitigation programme within the CSU,
- The third section outlines the ten (10) key interventions identified by the city to build a climate resilient and resource efficient city.

10.1 Climate Risk and Vulnerability Assessment (Adaptation)

Adaptation is wide-ranging and the current approach is mainly advocacy-based, ensuring that different role-players are aware of and responding to the city's climate hazards and risks as identified in the city's Climate Risk and Vulnerability study².

The most notable indicator is rising temperatures. In the Tshwane region these have been increasing significant over recent decades – at about twice the global rate. Although there are as yet no significant changes in rainfall, there is a downward trend in the maximum number of consecutive wet days per year.

How these climate patterns will develop in the future is described by the outputs of computer-based models in line with the global climate system called Global Circulation Models (GCMs). The models are used to predict how regional climate systems will respond to changes in the troposphere resulting from an intensified greenhouse effect. A 60km² resolution downscaling of six different GCMs is used for the purposes of understanding how the climate of the Tshwane region will develop up to the year 2100. Each of the models are run under the assumption that coordinated global efforts at mitigating carbon emissions will remain limited and that CO₂ concentrations double (as compared to pre-industrial values) by about the mid-21st century – also known as the A2 scenario of the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emission Scenarios (SRES).

The model outputs confirm that temperatures will continue to climb, with a rise of up to 2°C for the near-future period (2015-2035), between 1 and 3°C for the mid-future period (2040-2060), and 4 to 7°C projected over the region for the period 2080-2100. Rainfall anomalies exhibit a clear pattern of drying, which strengthens over time, although the scale of drying will be limited.

Extreme weather also becomes a concern. The climate model shows a drastic increase in the number of very hot days (days with maximum temperatures exceeding 35°C) in the second half of this century. Whereas the current annual average is 40 very hot days per year, the annual number of very hot days will range between 100 and 180 days by 2100. This implies that it is plausible for almost all days during the summer half-year to have maximum temperatures exceeding the 35°C threshold.

Extreme rainfall events (>20 mm of rain falling within 24 hours over an area of 50km²) are of less concern, although the climate models point towards an increased frequency of extreme events in future. These events typically exceed the capacity of infrastructure to deal with the runoff, leading to flash floods or general flooding of low-lying areas. Three prominent themes emerging from the assessment is the correlation between poverty, social vulnerability and climate impacts, as well as disaster preparedness and the role of natural buffers in building city resilience. These then find similar focus in programmes driven particularly by the CSU.

10.1.1 Social Vulnerability Assessment

The impacts of climate change are more notable within urban poor populations, in particular extreme weather events. The vulnerability of the urban poor stems from the lack of crucial infrastructure and basic services, together with poor quality housing. It is therefore essential for the city to identify and map high areas of vulnerability, in order to focus adaptation strategies towards the most vulnerable

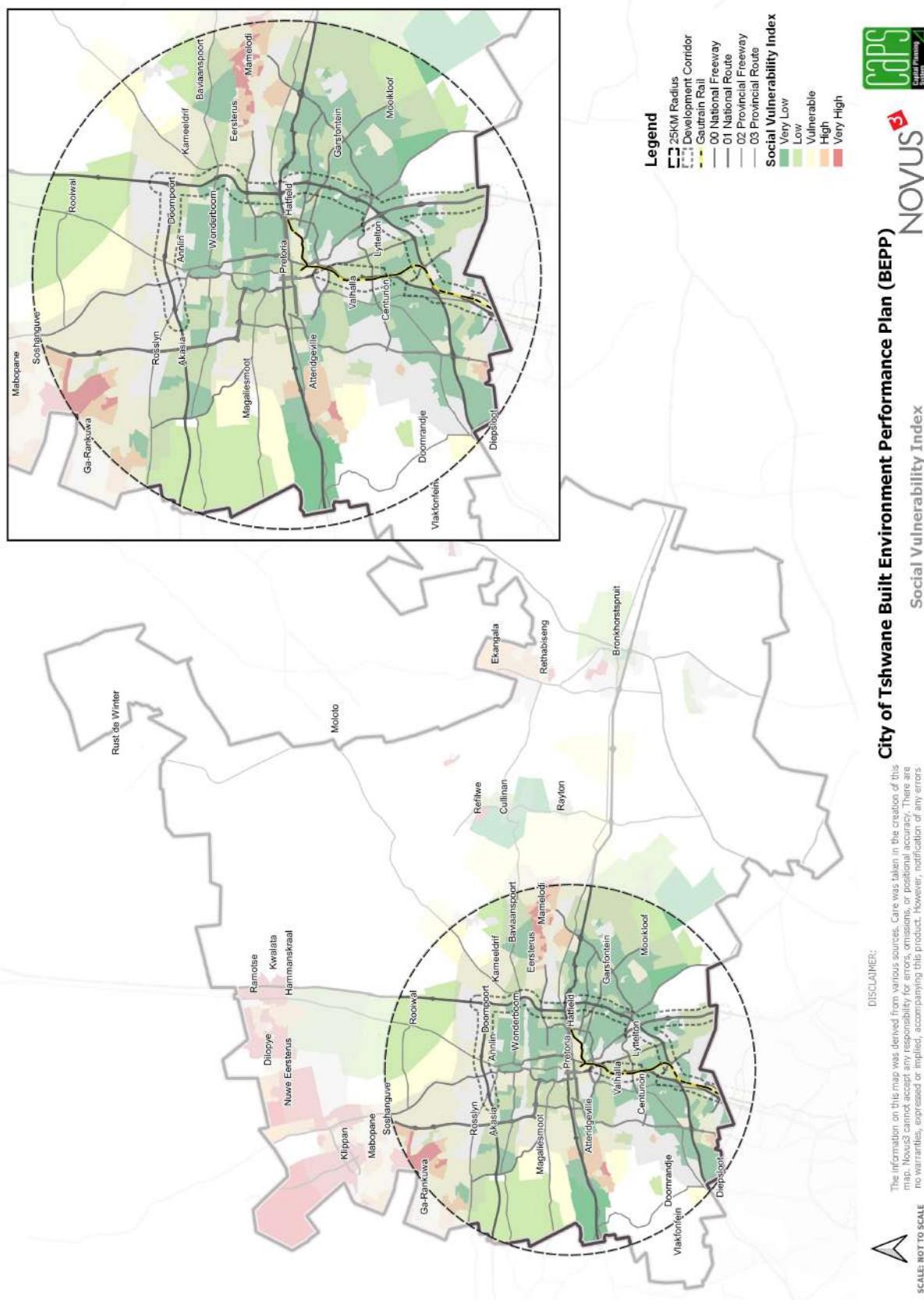
² Completed in September 2015.

within the City. The social vulnerability index aims to identify and map high areas of vulnerability and has been calculated based on a number of socio-economic variables.

Figure 36 below indicates the results of the vulnerability assessment³. Region 1 together with Region 2 contains the highest social vulnerability to climate change impacts. Both regions are characteristic of highly populated areas located within informal settlements and aligns to the results of the deprivation index, prepared as input to the CPM. The deprivation index outlined underserved township areas including Atteridgeville, Temba, Mamelodi, Mabopane and Soshanguve as the most deprived areas which have the lowest levels of access to basic services.

³ Areas that have been indicated as “blank” areas have very low population densities and/or fewer households.

Figure 36 Social vulnerability index



The socio-economic indices used to calculate the vulnerability index were based on national census data, which has been spatially linked to Census 2011 sub-place boundaries. Table 12 below outlines the socio-economic indices used as input variables to the vulnerability assessment together with the region containing the highest comparative score.

Table 12 Socio-economic variables included within the vulnerability assessment

Attribute	Region with highest comparative score	Regions						
		1	2	3	4	5	6	7
Type of housing (shacks)	5	Green	Yellow	Green	Yellow	Red	Orange	Orange
Education (older than 25 years, no education)	7	Green	Green	Green	Green	Green	Green	Yellow
Employment: unemployed	1	Red	Red	Green	Green	Yellow	Yellow	Yellow
Household density (> 4 people/room)	1,5,6	Yellow	Green	Green	Green	Yellow	Green	Green
Poverty line (hh earning < R400/month)	1	Red	Red	Green	Green	Yellow	Yellow	Red
Economic dependency (young and old compared to economic active population)	3	Green	Yellow	Red	Orange	Green	Orange	Green
Physiological dependency (young and old)	2	Red	Red	Green	Green	Yellow	Yellow	Red
Air pollution (fuel use other than electricity)	5	Green	Green	Green	Green	Yellow	Green	Green
Access to water (no piped water)	2	Green	Yellow	Green	Green	Green	Green	Green
Single parents (female-headed households)	1	Red	Yellow	Green	Green	Green	Yellow	Yellow
Child-headed households	7	Green	Yellow	Green	Green	Green	Green	Yellow
Access to transport (no car)	1	Red	Red	Green	Green	Orange	Green	Yellow
Access to information (neither radio or cell phone)	1,2,5,7	Yellow	Yellow	Green	Green	Yellow	Green	Green
In need of assistance (determined by problems with hearing, mobility, seeing, self-care, speaking)	1	Red	Yellow	Orange	Yellow	Green	Orange	Green
Social cohesion (non-South Africans in informal areas for < 2 years).	1	Red	Yellow	Orange	Red	Green	Yellow	Green
Nutrition (malnutrition of children < 5 years old)	1	Red	Orange	Red	Green	Green	Red	Green
Population density	1	Red	Green	Red	Yellow	Green	Yellow	Green
Total Score		Red	Green	Orange	Yellow	Green	Yellow	Green

Vulnerability classification							
					Low vulnerability	High vulnerability	

Based on the table above, Region 1 remains the most vulnerable area due to factors associated with unemployment, poverty, poor access to public transport, high dependency ratios and high population density.

10.1.2 Priority risk factors and adaptation options

Together with the social vulnerability indicated above, the climate risk and vulnerability assessment identify four (4) major types of weather events affecting the city together with seven (7) key sectors at risk.

10.1.3 Extreme weather events

The four major weather events which affect the city includes floods, drought, heat waves and hailstorms. The impact of these weather events fluctuates based on the social vulnerability indicated above together with the severity of each event. Table 13 below indicates the impact of each weather event, together with contributing factors and the areas or regions which are most affected.

Table 13 Extreme weather events and affected areas

Weather event	Description	Areas most affected
Floods	<p>Flooding occurs within low-lying areas around the City, with a larger impact on densely populated informal settlements located within floodplains. Contributing factors:</p> <ul style="list-style-type: none"> ▪ Ageing infrastructure; ▪ Inadequate storm water drainage systems; ▪ Geographical location of human settlements, and; ▪ Poor and vulnerable communities. 	<ul style="list-style-type: none"> ▪ Region 1 – Soshanguve, Hammanskraal, Ga-Rankuwa and Mabopane ▪ Region 2 - Annlin and Sinoville ▪ Region 3 – Atteridgeville ▪ Region 4 – Centurion ▪ Region 6 - Mamelodi and Moretele
Droughts	Droughts mainly affect the agricultural sector.	<ul style="list-style-type: none"> ▪ Region 1 - Soshanguve, Winterveld ▪ Region 3 – Atteridgeville ▪ Region 6 - Moretele Park
Heat Waves	Heatwaves are described as pro-longed periods of excessive heat which can be detrimental to human and animal health. In addition to health concerns, heatwaves also affect the agricultural sector.	<p>The occurrence of heatwaves cannot be specifically attributed to areas or regional boundaries. Populations groups more susceptible to heatwaves include:</p> <ul style="list-style-type: none"> ▪ Children; ▪ People with respiratory diseases; ▪ Elderly people and people with disabilities, and; ▪ People with diseases such as epilepsy.
Hailstorms	Hailstorms are the result of convective summer climates which lead to thunderstorms. Damage which stems from hailstorms include automobiles, aircrafts, skylights, glass-roofed structures, livestock and crops, and sometimes human fatalities.	Areas surrounding the Magaliesberg mountain range

10.1.4 Key sectors at risk

The following key sectors have been identified as most vulnerable to the impacts of climate change.

Table 14 Key sectors at risk

Key Sector at Risk	Description	Impacts
Biodiversity	<p>Natural ecosystems are at risk due to land-use changes which results in land degradation and the introduction of alien plant species.</p> <p>Contributing factors:</p> <ul style="list-style-type: none"> ▪ Temperature increase; ▪ Rising levels of atmospheric CO₂, and; ▪ Changing rainfall patterns. 	<p>The City consists of two (2) biomes namely grassland and savannah which contain ecosystems under threat. The grassland biome is highly-vulnerable to land-use and climate change and has been ranked as the second-most vulnerable. The Department of Environmental affairs have projected substantial change and loss of habitat for the grassland biome (DEA, 2013a; Driver et al., 2011). Loss of the grassland biome will impact the following:</p> <ul style="list-style-type: none"> ▪ Goods and services including water resources from highland catchments used for agricultural activity, and; ▪ Conservation and ecosystem processes such as wildfires.
Water Resources	<p>The city contains a number of water sources in the form of dams, rivers, wetlands and groundwater. Continued population growth together with the increase of economic development and higher standards of living will ultimately provide increased pressures on the current water resources available to the city. Climate Change adds to these pressures due to the impact it has on rainfall variability, weather events and increased surface water loss due to warming temperatures.</p>	<p>Impacts of reduced water resources include:</p> <ul style="list-style-type: none"> ▪ Water availability for functioning processes; ▪ Water quality; ▪ Changes in rainfall intensity; ▪ Human and animal health; ▪ Aquatic systems; ▪ Functioning of existing infrastructure like that of wastewater treatment plants and storm-water networks; ▪ Drought; ▪ Economic sector impacts (agriculture, power generation, industrial processes), and; ▪ Food security.
Agriculture	<p>Agricultural areas are mostly located within the eastern parts of the city which contain mostly extensive chicken farming, cattle farming and dryland and irrigated cultivation.</p>	<p>Impacts of climate change include:</p> <ul style="list-style-type: none"> ▪ Food security; ▪ Economic development; ▪ Maize crop yield; ▪ Livestock mortality rates, and; ▪ Higher frequency in veld fires which increases the risk of damage to grain and cattle farms.
Health	<p>Increase in the depth and intensity of high-pressure systems during winter is associated detrimental effects on air pollutants and the production of near-surface ozone.</p>	<p>Increased temperatures directly affects heat-induced stress for humans and animals, giving cause to health related concerns.</p>

Key Sector at Risk	Description	Impacts
Urban Planning	Key driver for adaptation strategies through spatial planning. Focus areas include informal settlements and densely populated areas built within the flood line. The risk profile for types of housing and density of settlements encouraged through urban planning strategies determines the risk profile of certain areas.	Due to the lack of basic infrastructure and services, informal settlements are at greater risk during the occurrence of climate change events. The city has 150 informal settlements containing dense populations of which the majority are located within Region 1, Region 3 and Region 6.
Energy	The bulk of electricity generation within the city is generated by coal power plants in surrounding areas.	The city is vulnerable to the impacts of climate change in the form of weather events like that of lightning, increased occurrence of heatwaves and veld fires which damage power transmission lines. Due to increased temperatures, energy demand is likely to increase during summer and decrease during winter.
Infrastructure and Transport	Damage to infrastructure stems from flash floods as a result of slow-moving thunderstorms associated with lightning, damaging winds and hail.	The main climate risk within the city includes that of flash floods which damages existing infrastructure.

10.1.5 Priority risk factors

In conclusion to the city's Climate Risk and Vulnerability study, a number of priority risk factors were identified. These risk factors originated as a result of the social vulnerability assessment together with the risks identified in terms of extreme weather events and impacts on key sectors. The eight (8) priority risk factors identified include the following:

- Risk factor 1: Loss of ecosystem goods and services
- Risk factor 2: Increased energy demand
- Risk factor 3: Increase in diseases affecting human and animal health
- Risk factor 4: Damage to infrastructure (i.e. stormwater systems, roads, bridges)
- Risk factor 5: Water insecurity
- Risk factor 6: Flooding and damage to human settlements and private property
- Risk factor 7: Increase in sinkholes
- Risk factor 8: Decreased productivity of agro-ecosystems affecting food security

Together with each risk factor, the Climate Risk and Vulnerability study outlines possible adaptation measures together with regions of focus (targeted regions), refer to "City of Tshwane Climate Risk & Vulnerability Assessment (abridged version)" for details pertaining to the suggested adaptation measures.

10.2 Greenhouse Gas Emissions Inventory (Mitigation)

The key driver behind the Mitigation Programme is the Greenhouse Gas Emissions Inventory (GHGEI). The GHGEI for 2014/15 financial year complies with the Global Protocol for Community-Scale (GPC) Greenhouse Gas Emissions Inventories and this has been independently verified. For more detail pertaining to the Climate Resilience and Responsiveness Greenhouse Gas Emissions Inventory (GHGEI) refer to Addendum 3 of this document. It reveals that the city is emitting 21 million tonnes of carbon dioxide equivalent (21mtCO₂e) per annum, which is equivalent to 7 tCO₂e per capita. The three broad areas of emissions are energy (59%), transport (21%) and waste (20%) and these inform the response in terms of the Mitigation Programme.

Energy emissions are related to the manner in which the city powers buildings and various industries. Energy is primarily sourced from the national utility (Eskom) which has built up a national network of coal-fired power stations and has been slow to embrace sustainable alternatives.

Waste emissions are due to the manner in which the city manages waste, primarily landfilling which includes organic waste. This is one area that the CSU has identified as being directly within the city's control, thus having the ability to adopt more modern and environmentally sensitive waste management practices that will reduce emissions.

The third source of emissions is from the transport sector which is primarily affected by the city's spatial legacy. The spatial legacy has been based on principles of separated development and a lack of comprehensive networks which provide safe and reliable public transport modes. The city has a direct influence within the transport sector and has identified long-term intervention. Long-term intervention of the city's transport sector includes increased investment into public transport, amongst others the TRT system.

Table 15 below indicates a high-level overview of the mitigation focus within the CSU and characterises the intervention requirements as per the energy, waste management and transport sectors.

Table 15 Mitigation interventions

Low Carbon Energy Future	Sustainable Waste Management	Clean Mobility
Promoting energy efficiency: Green Building By-law which reinforces passive design features.	Promote separation at-source: all households and businesses separate recyclable waste from non-recyclable waste to enhance levels of recycling	Spatial planning to yield compact and dense cities (MSDF, RSDFs, Precinct Plans)
Self-generation: a focus on self-generation under 1 MW facilitated by the Embedded Generation Policy and Guidelines	Divert waste from landfill: cost neutral green economy projects to enable the private sector to put recycling infrastructure in place	Sustainable Public Transport: Bus Rapid Transit system inclusive of CNG buses in support of the C40 Clean Bus Declaration
Waste-to-energy: Cost neutral green economy projects targeting our waste water treatment works and residual waste (municipal solid waste)	Waste-to-energy: production of energy from the processing of residual waste and Waste Water Treatment Works (Formalisation of informal waste-pickers and protect their human rights)	Innovative & modernising service delivery: CNG buses with WIFI, electric vehicles for messenger fleet, solar charging stations. Promoting non-motorised transport: The annual Green Ride, Kasi Rides and 2018 Car-Free day and advocating for NMT infrastructure to accompany road

Low Carbon Energy Future	Sustainable Waste Management	Clean Mobility
		infrastructure development and upgrades; Tshwane Bike-Share Pilot at UP

10.2.1 Climate response strategy – Ten (10) key interventions

The city's Climate Response Strategy (CRS) was released as a final draft document during 2018, with the aim of establishing the current climate change context within the city together with the identification of ten (10) key intervention programmes focussed at building a climate resilient and resource efficient city. It should be noted that this document is regarded as a precursor to the City of Tshwane's CAP, which will be developed under the C40 Cities Programme⁴, and to be submitted at Council for approval by March 2021.

The ten (10) key intervention programmes identified within the CRS has been outlined below and was established based on a strategic review of current climate assessments together with stakeholder engagements. Each intervention includes a short description, for details pertaining to each intervention refer to the "The City of Tshwane - Climate Response Strategy (2018)".

- **Intervention 1: Enhance and protect the city's natural ability to buffer climate change impacts.** The city has an abundance of natural resources which provide invaluable ecosystem services such as heat mitigation, flood attenuation and enhanced water quality. These are under threat partly due to development patterns in the city. The city is striving to put protective measures in place for 31 priority wetlands by 2021 according to its Wetlands Management Plan (WMP). The city's land use planning and natural resource management will be closely guided by the bioregional plan which identifies biodiversity priority areas.
- **Intervention 2: Develop an integrated approach to water management in the city.** Water scarcity has been anticipated within the Climate Risk and Vulnerability Study. The city is dependent on bulk water supplied by Rand Water, a quarter of which is lost through ageing infrastructure. The city is aiming to develop an integrated and holistic approach to water management, diversifying the water mix and exploring the re-use of groundwater, stormwater and rainwater. A Water Demand Management Programme inclusive of leaks management will be intensified with penalties for non-compliance.
- **Intervention 3: Build climate resilient communities.** The nexus between exposure and vulnerability to climate risks and social vulnerability is self-evident. The urban poor bears the brunt of climate impacts and have low levels of resilience. Urban populations with access to resources indicate an increase in water and electricity consumption to cope with climate impacts. Disaster management is yet to fully and explicitly address climate change. The city is ensuring that a set of interventions address poverty, exposure to climate hazards, status of informal and high-risk dwellings together with general health and wellbeing. Initially, resources will be focused on refining knowledge and an understanding of climate impacts together with multi-disciplinary and stakeholders' forums which will

⁴ City of Tshwane was accepted as the 70th member of the C40 Cities Climate Leadership Group (C40) in September 2014. C40 is currently rolling out the African leg of its Global Climate Action Planning Programme. Launched in May 2018, the programme currently provides comprehensive technical support to 11 cities on the continent, including the City of Tshwane, to develop ambitious and equitable Climate Action Plans in line with the objectives of the 2015 Paris Agreement.

focus on building urban resilience. Disaster management will prioritise disaster risk reduction measures.

- **Intervention 4: Promote mixed-use densification and transit-oriented development.** The city's historic spatial form is characteristic of urban sprawl, which resulted in high population densities on the periphery resulting in unreasonably long, and costly, commuter distances. The unsustainable nature of historic spatial planning is the cause of more than four (4) million tonnes of carbon dioxide equivalent yielded annually within the transportation sector. Modern and efficient modes of transport such as the TRT system and strategies to densify and diversify urban nodes are central to overcoming these spatial inefficiencies. Transit Oriented Development (TOD) will integrate spatial planning, building design and transport infrastructure.
- **Intervention 5: Promote cleaner mobility.** Current trends indicate that motorised transport will remain the main mode of transport within the city. However, mass transit and cleaner modes of transport have been introduced with the aim of reducing transport-related emissions. The following has been implemented within the city:
 - The TRT system has forty CNG-propelled buses which will be fuelled from landfill gas;
 - The corporate fleet of the city has introduced ten (10) electric vehicles together with solar-powered Electric Vehicle (EV) charging stations;
 - Infrastructure for electric vehicles will be rolled out in the city through partnerships with the private sector and the South African National Energy Development Institute (SANEDI), and;
 - Non-motorised transport (NMT) will become an increasingly viable mode of transport.
- **Intervention 6: Retrofit existing buildings and build green buildings.** Buildings have been classified as a source of high resource consumption during the process of construction and maintenance. This has prompted the city to endorse a Green Building Policy and By-law. The city is a member of both the Green Building Council of South Africa's (GBCSA) Green Building Leadership Network (GBLN) and the World Resources Institute's BEA Programme. Through the BEA programme, the city is in the process of retrofitting the HB Phillips building located within the inner city as part of a general upgrade. This project aims to illustrate that older buildings can operate optimally through retrofitting and green building initiatives. Tshwane House, home to the municipal headquarters, is a 5-star rated green building.
- **Intervention 7: Promote energy efficiency.** The city's main sources of energy stem from carbon heavy resources. However, before the city can focus interventions towards the source of energy, reduction in energy consumption should be achieved. To achieve this the city has opted to introduce the following:
 - Energy efficiency measures which include energy-saving lightbulbs within municipal buildings and streetlights;
 - Installation of solar water heaters in low-income housing;
 - Assessing the efficiency of operations such as the wastewater treatment works, and;

- Exploring ways of enhancing the thermal efficiency of poor designed and constructed homes through simple but effective interventions such as the application of cool coatings.
- **Intervention 8: Promote cleaner and renewable energy.** The city is primarily dependent on electricity derived from coal-fired power stations which is also a source of revenue for the city. This dependence translates into close to half of the city's carbon emissions. An Embedded Generation Policy (EGP) has been established and there is a steady progression of renewable energy installations within the city that are below the licensing threshold. The city is investing in renewable energy systems for own use to reduce operational costs, with hydro-energy gaining traction in the water reticulation system. Together with the above, the city is advocating for low carbon alternative energy solutions to meet suppressed demand, particularly within informal settlements.
- **Intervention 9: Divert waste from landfills and find innovative uses for waste.** The GPC Greenhouse Gas Emission Inventories indicates that 10,848,006 of CO₂ is produced annually, based on current waste management practices. Little diversion of waste takes place and recycling typically occurs through informal recycling practices. The city aims to facilitate and implement the following:
 - Diversion of waste from landfills, through the implementation of separation at-source and recycling infrastructure;
 - Processing of residual waste to produce energy, and;
 - Capturing of landfill gas to power vehicles.
- **Intervention 10: Pursue sustainability support mechanisms.** A key lever for change is the city's purchasing power and hence a Sustainable Procurement Policy (SPP) has been adopted. The SPP aims to ensure that the city's capital and operational expenditure supports a sustainability agenda. Uptake is being prompted through supplier development programmes to enable suppliers to fulfil the requirements of revised, more sustainably oriented specifications. The city is a member of the Global Lead City Network on Sustainable Procurement. Examples of sustainable procurement implemented, include:
 - Tshwane House, the city's municipal headquarters, which was scoped to be a five-star green building;
 - The purchasing of electric vehicles for the corporate messenger fleet, and;
 - CNG propelled buses for the TRT system.

The interventions which have been outlined above speaks to city wide adaptation and mitigation strategies. In planning and effecting these ten (10) interventions, the climate response strategy emphasises the importance of climate mainstreaming by having sustainability champions in each department and ensuring representation in key decision-making forums such the Budget Steering Committee (BSC) and the BEPPSCO. Refer to Chapter 7 of the BEPP for institutional arrangements pertaining to the BEPPSCO, and to Chapter 4 which outlines the introduction of CR&R focus areas within these forums and the capital planning and prioritisation process. Chapter 14 outlines the Capital Prioritisation Model (CPM) of the city and indicates where the results of the social vulnerability assessment together with the ten (10) intervention programmes have been incorporated into the model.

11 Institutional Arrangement

11.1 Spatial Transformation

The theory of change with respect to spatial targeting, aims to achieve key actions, namely:

- The identification of a Public Transport Backbone;
- The Establishment of Transit Oriented Development, and;
- The unification of a clear spatial policy directive.

It further sets achievable targets, by for public and private sector, relating to compaction of housing and a diversified land use mix; densification and better space efficiencies; increased access to transport choices and prioritised investment in catalytic land development programmes.

The mentioned actions and targets aim to realise the ultimate vision of the City, with respect to spatial targeting, which are clearly defined as a stimulated economy which results in economic growth and job creation; an inclusive City; improved service delivery and a well-protected natural environment.

To date, the City has made significant changes to position itself towards the achievement of the said targets. The City constructed its first line as part of the IPTN network, which represent the beginning of a public transport backbone. It has prioritised several precinct plans, related to Transit Oriented Development, which are ready for private sector uptake. There is, however, still a lot to be done, and if executed correctly, can fast-track the City towards the desired future state.

The City has set about in updating the MSDF, which incorporates several elements that was previously lacking. Key updates include the delineation of integration zones, mixed use areas, housing development, and agricultural activity. The MSDF should serve as guide to other public entities such as provincial government, when spatial conceptualisation and strategizing occurs. This will lead to more space efficiencies, coordinated investment, optimisation of limited public resources and essentially long-term benefits on a national scale. This will be realised through continual engagement on the Tri-metro forum – but with specific focus on spatial targeting. The end goal would be a true meeting of the minds between metropolitan and provincial spatial targeting.

IPTN Operational Plan: The IPTN is the first project of its kind in the City. To date, it resulted in a functional activity spine, that runs through the heart of the City, connecting areas that was previously disconnected, and restructuring the urban form even this minute. The original Operational Plan must however be revised as several underlying deterministic forces have changed since the inception of the IPTN program. An alteration in the IPTN operational plan, will have a direct impact on spatial targeting initiatives, and so on spatial restructuring targets.

Human Settlements Plan: The human settlements plan utilised within the City, guiding public sector investment in human settlements was drafted as part of the National Upgrading Support Program in the absence of a local level human settlements plan. The result being a reinforced spatial structure as opposed to a restructured spatial structure. The City has, since the previous reporting period, established a subdivision within the department of human settlements, specifically responsible for policy formulation – with the intent to develop the City's policy on Human settlements development and to compile a specific plan regarding human settlements.

Transport and Housing Alignment: Though it will probably never be possible to provide alternative housing for all of the residents currently living in peripheral areas of the City of Tshwane, the most likely solution is to do everything possible to enhance the sustainability of existing housing

development for the poor in these areas, but to refrain from encouraging extensive future expansion of the footprint of such peripheral areas. Instead, the approach should rather be to concentrate on offering a choice of housing in areas as close to the core areas of the city as possible in line with the Breaking New Ground Policy. In this regard the focus should be on the following areas:

- Existing metropolitan activity nodes and corridors as well as integration zones as identified in the MSDF;
- Centralised locations where there are vacant municipal, state and parastatal-owned land;
- Areas close to major inter-modal transportation facilities and specifically the Integrated Rapid Public Transit Network of the city, and;
- In the longer term, new areas with a definite potential to become metropolitan activity nodes.

Land Release Strategy: The City is in process to develop a Land release Strategy, that will aim at selling off land in areas that has little market potential and / or reinforce the inherited urban structure. In turn the City will aim to purchase land in areas such as the integration zone, and other catalytic land development areas.

Precinct Planning and Land Use Development Forums: There are more than 40 precinct plans in the City, planning desired interventions and spatial structuring on a micro level. One of the key role players in this environment, on this level, is private sector developers. In order to entice the stimulation of the economic as desired by the City and as expressed by the City's Precinct Plans the City need to engage with private sector. Since the previous reporting period, the City has conducted several Planning Forums with the aim to gauge and guide public sector in development initiatives across the City.

11.2 Climate Mainstreaming

11.2.1 Climate Mainstreaming Effected in 2019/20

The 2019/20 BEPP outlined the structure of the City Sustainability Unit (CSU) together with the core elements which constitutes the City's Climate Change Profile namely mitigation; adaptation and sustainability financing and support mechanisms. Each of these elements consisted of focus areas specifically in line with the establishment of guideline documents and programmes. The 2019/20 BEPP also outlined the contribution made through the C40 Cities Climate Leadership Group and technical assistance provided to the CSU. This led to the establishment of climate change expertise and a number of initiatives/collaborations with various departments. For more information refer to Addendum 4 which describes the establishment and institutional arrangement included in the previous BEPP submission.

11.2.2 Development of the Climate Action Plan

Following the development of the Climate Response Strategy in 2017, the City Sustainability Unit has embarked on a process, with technical support from C40 Cities Climate Leadership Group, to develop a CAP that will provide guiding interventions with a thirty-year trajectory (2050). The outcome of the CAP aims to achieve a City which is carbon neutral and climate resilient by 2050. A key driver for this will be the establishment of a dedicated climate budget which will allow for the financing of specific projects designed to address climate change.

The planning process is comprised of the following workstreams: mitigation; adaptation; financing; climate mainstreaming; stakeholder engagement and communications and governance. Each workstream is headed up by an official in the CSU and involves engaging with interested and affected parties, both internal and external, that have a bearing on each workstream.

The process started in April 2019 when C40 appointed a technical advisor to guide the process. Several milestones have already been achieved which include a situational analysis, a stakeholder-driven SWOT analysis, and in-city workshops focusing on mitigation scenarios and complementing actions. The adaptation component has trailed behind somewhat as special provision was required to appoint the CSIR to assist the municipality with the adaptation planning as C40 funding was directed at mitigation only.

The intention is for the plan to be approved by Council by March 2021, namely before the next local government elections. Therefore, a draft document will be required for public circulation by the end of 2020.

11.2.3 Adaptation Planning

In 2015, with technical support from the CSIR, the City completed its first Climate Risk and Vulnerability Assessment (refer to Chapter 10.1). The follow up to that body of work was an Urban Heat Island (UHI) study that determined the presence of urban heat islands in the City for current temperature. The next phase of the work will focus on the manifestation of the urban heat island effect for future temperature and will yield ward-based urban climate maps that will guide the exact interventions we need at a micro-scale. Due to the nuances of climate impacts, this is the surest way of ensuring that we build resilience from the ground level up.

The second phase of the urban heat island study is incorporated into a larger scope of work that CSIR has been appointed to render as part of the adaptation component of the Climate Action Plan. The scope of work entails the following areas:

11.2.3.1 Work Package 1: Phase II to Propose an Urban Heat Mitigation Strategy

Work in Phase II will build on the work that was already done in Phase I of the project, and will include the following tasks:

- **Task 1: Assess the impact of exposure to heat and the risk and vulnerability of communities in the current climate.**

The high-resolution model outputs will be used to assess and quantify the vulnerability of, and the impacts on human health. The assessment will use a Human Health Impact Assessment framework. Heat thresholds will be defined through a literature review, and applied in this task, Task 3 as well as in Working Package 4 for the heat aspects.

- **Task 2: Simulate UHI under future climate change with planned urban development (e.g. future business as usual (BAU)).**

The Tshwane-tailored urban model developed in Phase I for current climate, will be updated for a future Tshwane (BAU). Using this parameterisation of the city, the UHI under future climate will be simulated. Regional CCAM output will be further dynamically downscaled using the Conformal-Cubic Atmospheric Model (CCAM) Urban Climate Model (UCM) Town Energy Budget (TEB) model to produce high-resolution climate scenarios of all-important variables for the development of the heat profile over the City of Tshwane. An important consideration here will be the uncertainties that are introduced by the second layer of downscaling, noting that these already exist when downscaling

Global Circulation Model (GCM) data. It should also be noted, at this point, that the future climate change scenarios produced in this task assume current levels of the controllable factors or variables.

It is anticipated that the impacts of climate change on the future development of urban heat islands over Tshwane for the period 2016-2050 will be simulated under the business-as-usual climate scenarios (RCP8.5). The assessment will focus on future time slices of interest to Tshwane. These will be confirmed in the inception phase.

In addition to using these simulations in the following tasks in Working Package 1, these simulations will be used in the other Working Packages to provide high-resolution analyses/inputs of exposure to climate variables and extremes.

- **Task 3: Assess the impact of exposure to heat and the risk and vulnerability of communities under future climate.**

This assessment will use the same method as described in Task 1, but, this time, will use the future climate projections. The team will also model population growth areas (in Working Packages 2&3) which will be overlaid with high risk areas in the city making it possible to assess the potential risk to health and the extend of that in terms of numbers of exposed people and the spatial distribution of them.

- **Task 4: Develop urban climate maps.**

Urban climate maps will be developed for current and future climate in order to spatially identify UHI and resultant impact hotspots at a ward level. The development of the urban climate map will enable the assessment of the effects of existing urban structures on the UHI so as to understand the underlying climatic sensitivity (thermal load and ventilation paths) of the urban spaces within Tshwane Municipality. The urban climate map will be a tool that can be used to support the prioritisation of interventions (Task 5, below).

A detailed plan for the City to mitigate urban heat impacts will be developed in Tasks 5-7. These tasks align with the broader activities in Working Package 4, and aspects of this task will form part of and be integrated with that work. Through these tasks, the adaptation actions for mitigating the UHI and heat impacts will be assessed and will contribute to Working Package 4. As this work will develop actions through a detailed heat mitigation strategy that will inform Working Package 4, the tasks are detailed here in Working Package 1.

- **Task 5: Develop options to mitigate the UHI and make key recommendations.**

The prioritised technologies, in conjunction with the urban climate maps and activities in Working Package 4, will be used to identify and recommend focussed climate adaptation actions for specific areas identified as being potential UHI hotspots. These will be framed within the adaptation scenarios developed in Working Package 4.

The information derived in the preceding deliverables will be used to initially compile recommendations on how the City can respond to urban heat challenges. This will highlight the key areas with high temperatures and suggest possible interventions that could be implemented in these areas. Linkages will be made to current projects, programs, plans and policy development that could support or strengthen such interventions. Areas for further uptake and technological innovation gaps and the resulting/actions needed, will also be highlighted. Recommendations on the key capacity and financial requirements to implement the interventions will also be included.

The prioritised technologies will be used to develop climate adaptation (e.g. prioritisation of open spaces) and localised GHG mitigation pathways for the City through use of the urban climate maps developed in Task 4. The opportunities for these prioritised technologies to support the goals of the GHG mitigation pathways developed in the CAP will also be considered.

- **Task 6: Assess the UHI under future climate change under different development/intervention strategies.**

It is planned that these identified actions from Task 5 and together with the broader adaptation scenarios developed in Working Package 4 will be modelled in TEB-CCAM to quantify the impact on the UHI. If there are actions that cannot be simulated (e.g. drivers or parameters that do not exist in the model), this will be identified in Task 5 and assessments using other techniques (e.g. urban climate maps) would be explored.

The impact of the interventions on the UHI will be assessed in order to understand the impact of the strategies. The number of scenarios that can be modelled will depend upon the complexity of interventions and the difficulty in modelling the interventions.

- **Task 7: Develop the Urban Heat Mitigation Strategy for Tshwane.**

The content of this will be confirmed with Tshwane. It is anticipated that the other deliverables listed here are technical in nature, while this document will be a non-technical, integrated report, documenting the synthesised results which will be used to recommend appropriate UHI mitigation actions to Tshwane, for both now and into the future.

- **Deliverables:**

- Health Assessment of UHI in current climate
- Future projections of UHI
- Assessment of health impacts in future climate
- Urban climate maps and options
- Report on key recommendations
- Assessment of intervention scenarios
- Urban Heat Mitigation Strategy
- In addition to these UHI specific deliverables, this WP will develop the heat-related aspects for Working Package 4. This includes, key resilience indicators and their thresholds, and adaptation actions.

11.2.3.2 Work Package 2: Update the Climate Risk and Vulnerability Assessment

Assessing vulnerability to climate change is an essential task for identifying, quantifying and prioritising key climate risks, vulnerable communities, sectors or regions and enables decision-makers to develop appropriate response measures to adapt to climate change (O'Brien et al., 2009). Climate change risk and vulnerability assessments provide an indication of the range of risks that could affect human settlements and should include and quantify the spatial extent and intensity of how these hazards (including floods, droughts, extreme heat, and other hydro-meteorological hazards) will change under a shifting climate.

CoT commissioned such a CRVA study and the findings were incorporated in 2015 in a report "City of Tshwane Vulnerability Assessment to Climate Change". The report was reviewed by C40 and an update on certain sections/thinking was encouraged to facilitate the climate adaptation planning process and provide quantitative scientific evidence on high risk climate zones. In the past four years a number of highly relevant, novel and new supporting studies and methods have emerged and/or is currently in process to enhance the understanding of high-risk zones, which should be consolidated and incorporated. New scientific evidence and findings have also emerged taking a more forward-looking approach into account and should, where feasible, be considered and incorporated.

Output from Working Package 1 will be an input for this piece of work. The outcomes of this work package will be applied to directly influence the development of Working Package 3 and will form the base for discussion and support of Working Package 4. All new and existing evidence being generated, compiled and/or consolidated in this study will be made available via Working Package 5 and integrated where necessary within the CoT Corporate GIS and Disaster Management Centre.

The various tasks anticipated in this work package include:

- **Task 1: Rapidly screen current studies and available data with bearing to CRVA**

The purpose would be to investigate, understand and consolidate current studies conducted by e.g. the Disaster Management Centre, Corporate GIS, external consultant reports, etc. It is necessary to understand the spatial resolution, modelling approaches and availability of data to know which elements in the CRVA update needs more attention and what data has already been produced and is ready for streamlining. This will be done through a series of short engagements with current consultants, departments, reports and new findings that emanated over the past 4 years.

- **Task 2: Scope the CRVA elements to be updated**

Based on the review of C40, the required BEPP and CAP support and the understanding from Task 1, this task seeks to agree on the elements (data, indicators, information) to be incorporated (if already available) or to be analysed, modelled or constructed (if not available). The scoping study will also identify the desired resolution, scale and dimensions that should be included in the updated CRVA analysis.

- **Task 3: Conduct the CRVA assessment**

Conduct the CRVA assessment for identified elements. The level of detail and decision support provided by a climate risk and vulnerability assessment is highly dependent on the question and scale of the study. The elements that will be assessed and updated will be dependent on agreement and based on the findings in the two tasks above. It is vital that the evidence emanating from this study directly support the identification of high-risk climate zones in order to align the desired adaptation responses appropriately.

- **Task 4: Prepare CRVA findings in required format**

Compile necessary maps, statistics and information to support Working Package 3 and 4.

- **Deliverables:**

- Updated CRVA information in support of identifying high risk climate zones (Working Package 3).
- Customised indicators and information to be refined, to support climate adaptation plan (Working Package 4).

- Agreed upon maps, statistics, indicators and information compiled in a geodatabase at the desired resolutions and temporal scale, ready to be uploaded and implemented as part of an online planning support system (Working Package 5).

11.2.3.3 Work Package 3: Produce Climate Risk Zones

One of the strategic focus areas for the BEPP for the next three years is to mainstream climate-responsiveness and resilience into municipal planning, budgeting, and reporting processes. Requirements are set out to metros through the BEPP Supplementary Guidelines in support of reaching this goal. One of these requirements is to identify climate risk zones in the metropolitan area. This is in support of the outcomes required for the Tshwane Climate Action Plan and will therefore be addressed through this Work Package.

The climate risk zones will reflect on climate hazard exposure (flooding, heat and wildfire extremes), vulnerable infrastructure, and vulnerable communities within the metropolitan area. The risk zones would provide a basis for identifying priority areas for adaptation interventions.

Initial information, data sources and methodologies have been identified that can inform the identification of current as well as future climate risk zones in the City of Tshwane:

- High-resolution (e.g. 1 km²) downscaled climate model outputs available for the City that will be used to model the impact of climate on extreme events (e.g. flooding, heat (Work Package 1) and wildfire-extremes); and the 8 km x 8 km downscaled climate change projections that will be used to model future impacts.
- The updated Climate Risk and Vulnerability Assessment from Working Package 2.
- Population growth projections at a high resolution.

A detailed methodology for identifying climate risk zones will be developed during the inception phase of the project. During this phase additional City data and information sources will be identified to identifying vulnerable infrastructure, e.g. asset management information and/or property valuations.

- **Deliverable:**

This work package will produce a geodatabase of climate risk zones that would support the BEPP and the adaptation component of the Tshwane Climate Action Plan. The Climate risk zones data in addition to the updated CRVA data will be uploaded and implemented in an online planning support system (Working Package 5).

11.2.3.4 Work Package 4: Identify Adaptation Actions, Resilience Factors and Thresholds, Develop Adaptation Scenarios

Based on the existing and updated risk and vulnerability assessment, climate change adaptation actions will be identified and evaluated by considering vulnerability as determined by exposure, capacity and susceptibility. Based on the outcome of Work Packages 1, 2 and 3, this work package will identify adaptation actions and key resilience factors, develop adaptation scenarios, and identify resilience factor thresholds. The detailed methodologies for the proposed tasks under this work package will be developed during the inception phase.

- **Task 1: Identify adaptation actions and resilience factors**

Adaptation actions and resilience factors will be proposed for the various climate risk zones in the City. A methodology for the identification of criteria to prioritise adaptation actions will be developed

through engagement with CoT and other stakeholders. Criteria for prioritising adaption actions may include the extent of their impact, inclusive benefits and on their ability to fulfil City objectives. The C40 and Ramboll Foundation Monitoring, Evaluating and Reporting Framework (C40 and Ramboll Foundation, 2019) could, for example, be used as a point of reference to identify such adaptation actions in addition to the ones that have been identified in the Green Book. The C40 AMIA tool could, for example, be used to identify potential interactions between the adaptation and mitigation actions in order to maximise the opportunities for mutual reinforcement and minimise the potential risks and conflicts.

The potential social, environmental and economic benefits of actions will be assessed to ensure alignment with local priorities. The communication of these benefits will demonstrate the overall value of climate adaptation, helping to articulate the business and social case for action and the tangible benefits for communities. An assessment of the collective benefits of the adaptation plan will be undertaken to evaluate the equitable distribution of, and accessibility of benefit by vulnerable groups. This will indicate the extent to which inclusivity has been taken into account across the suite of actions and how specific vulnerabilities or inequalities in the city are addressed within the adaptation plan. Potential barriers to implementation will be identified early on in the process of identifying adaptation actions. These could relate to the changing political or regulatory landscapes; internal city operations and capacity; access to finance and engagement with stakeholders; and emerging technologies, innovations and disruptors. This task will also highlight the impact and cost of not adapting sufficiently.

This task also includes a desktop analysis of multiple resilience factors, variables and indicators that can be found in local literature and policy frameworks. From this body of literature, the key resilience factors relevant to adaptation planning, that are appropriate to the context, will be distilled and presented to the City and selected stakeholders and peer-reviewers.

The full list of adaptation actions and resilience factors will be informed, where possible, by impacts from existing actions and major actions implemented/planned by other tiers of government. Stakeholder involvement is therefore required in this task.

- **Task 2: Develop adaptation scenarios**

The mitigation planning process that also forms part of the Climate Action Plan has identified three GHG mitigation scenarios. The same concept can be applied to adaptation planning. Three adaptation scenarios, based on the risk profile of the City, will be developed. Examples of scenarios could include: what will the impact be when no adaptation measures are introduced; what will the impact be when some adaptation measures are introduced (a realistic outcome given the City's resources and capabilities); and what will the impact be when all proposed adaptation measures are implemented to safeguard the City against potential climate risks, regardless of cost.

The final selection of adaptation scenarios will be workshopped and developed with the input from selected internal and external stakeholders. Linkages to the mitigation scenarios will be made where applicable, to emphasise opportunities for synergies.

- **Task 3: Determine resilience factor thresholds**

Once agreement has been reached on the resilience factors, the thresholds of these factors will be determined (qualitative or quantitative, depending on the availability of data). The method for extracting and determining these thresholds need to be developed as part of the inception phase of the project.

- **Deliverables:**

- Adaptation actions that will be linked interactively to the high-risk zones in the online tool.
- Various workshops and stakeholder engagements.
- Three adaptation scenarios.
- Key resilience indicators and their thresholds.

11.2.3.5 Work Package 5: Disseminate via Online Planning-Support System

The CSIR has recently developed a novel, online municipal decision support tool called the Green Book: Adapting South Africa's settlements to climate change (www.greenbook.co.za). It has been enthusiastically received by stakeholders in the climate change adaptation space and commended as the way to go with disseminating research findings and recommendations. It is proposed that this platform be used and amended as a means to host most of the output from the various work packages such as key research findings, maps, datasets, recommendations, etc. on the existing Green Book site under the City of Tshwane profile. Since the technologies and platform have already been designed and developed, the City will hugely benefit from this investment, and will save costs by not having to develop a new system or tool. Other benefits include accessibility of information to all municipal departments, its consultants, business customers and residents. The platform will thus provide baseline information for further work to build on, reduce duplication by departments, develop a shared understanding of the issues related to climate change and its impacts on the City, and promote mainstreaming of scientific evidence and climate adaptation actions into all municipal sector department plans.

A specific need has been expressed by the City that such an online platform should allow the users to be able to extract the data that they need for their various purposes from such a platform. This is not an explicit function that the Green Book has currently. However, CSIR does have the necessary ICT infrastructure, safety protocols and server environments to allow the development and inclusion of this additional functionality in the custom environment that will be developed for the City.

- **Deliverable:**

- Online dissemination platform

11.2.4 Climate Mainstreaming Way Forward

Much of the work being undertaken by the City Sustainability Unit concerns climate mainstreaming whether it be commenting on policies and plans from a climate change perspective or developing by-laws and specifications to achieve particular sustainability outcomes. Key to climate mainstreaming is applying science to City functions whether it is demonstrating how a City function can emit less greenhouse gas emissions or contribute to the lessening of greenhouse gas emissions or how a City function can adapt to changing climate as a risk reduction and resilience building measure.

The science is embodied in the greenhouse gas emissions inventory, the most recent one is for 2015/16 financial year and the Climate Risk and Vulnerability Assessment (CRVA) which is now being updated.

The Unit is constantly identifying “entry points” or opportunities to influence policies and plans by applying knowledge on a particular issue – in this case it is the findings of the greenhouse gas emissions inventory and the climate risk and vulnerability study. There are four main entry points

namely legislated plans, capital plans, bylaws and policies, and supply chain (sustainable procurement especially with regard to operational expenditure which is far greater than our capital expenditure).

- **Legislated and sector plans:**

Some of the key legislated plans that can benefit from climate action mainstreaming include the Integrated Development Plan (IDP), the Integrated Transport Plan, the Integrated Waste Management Plan, the Disaster Management Plan, the Air Quality Management Plan, and the Macro and Regional Spatial Development Plans. To date, we have been engaged successfully with all of these plans and to a lesser extent with the IDP.

The Comprehensive and Integrated Transport Plan (CITP) has an entire chapter dedicated to sustainable transport addressing non-motorised transport and a modal shift to low carbon technologies. In this financial year, as a deepening of the intentions of that chapter, the City in association with the C40 Climate Finance Facility, has embarked in a process planning and scoping study for an urban modal shift. Here the focus is on incorporating NMT infrastructure on Solomon Mahlangu Driver (M10) from Nellmapius to accommodate the many people that commute on foot and bicycle.

As the main planning tool for the City, the Integrated Development Plan, we have had limited impact. We are typically associated with one of five Strategic Pillars and this is referred to as Pillar 3: A City that delivers excellent services and protects the environment. Our approach has always been that sustainability is cross-cutting and has relevance to all strategic pillars. An example: Strategic Pillar 4 states that we are a city that keeps residents safe - this pillar is vital for supporting the goal of reducing transport related emissions through cycling and walking but if people do not feel safe than they will prefer to move around using motorised transport. This observation indicates that climate mainstreaming still has a way to go but the adoption of the Climate Action Plan should assist with mainstreaming particularly where departments and departmental leadership are assigned Key Performance Areas (KPAs) and Indicators that are aligned to the achievement of the plan.

- **Precinct Plans**

SPLUMA guidelines make provision for precinct plans. City Planning has developed a precinct guideline and we have had our first experience of applying climate change knowledge to that plan through an advisory committee focusing on the Hatfield village. The use of precinct plans to advocate for climate change mainstreaming was incorporated into the former BEPP submission and recognized for being innovative.

We see major opportunity in incorporating climate actions in Precinct Plans. Precinct plans allow for addressing concerns such as heat stress, air quality management, climate proofing of infrastructure, green buildings development, NMT promotion (pedestrianisation, cycling lanes), pocket parks and greening, storm water retention and management of stormwater drains, separation at source and recycling programmes.

- **Macro Spatial Development Framework**

The MSDF has been updated internally in the 2019/20 financial year and all departments were engaged on their plans for the future and variables and indicators that need to be incorporated into the revised MSDF. The Climate Risk and Vulnerability Assessment has been a source of some of these variables and indicators as well as the outcomes of the urban heat island study. The latter is incredibly important as there is conformity between the City's development trends and the manifestation of the urban heat islands. Therefore, in projecting and shaping development, the MSDF needs to be explicit on the need for cooling measures and these then need to be reflected in the Landuse Scheme since

the UHI is a cumulative effect of individual developments, each with insufficient passive cooling measures.

- **Capital Planning**

The BEPP has been instrumental in creating the opportunity to address Climate Responsiveness & Resilience in planning for the built environment. The focus now is how to incorporate the updated Climate Risk and Vulnerability Assessment so that the prioritization of capital projects is influenced by the sort of vulnerability it is addressing and its relationship to identified climate risk zones. More importantly and this has not been addressed as yet is that in the planning of capital projects these considerations are at the very forefront of the process.

- **Supply Chain**

in 2014, the City Sustainability Unit initiated a discussion on sustainable procurement, and this led to the development of a Sustainable Procurement programme that included addressing the notion of sustainable procurement. Where possible and feasible, the City Sustainability Unit endeavours to comment on specifications and be part of particular bid specification committees. One example is the Tshwane Housing Company where we sat on a bid specification committee and comment on a specification for social housing. In this example, we advocated for low-flush toilets to be included. However, the Unit also promotes demonstration projects, and in this financial year, it financed the installation of a photovoltaic system on the roof of the Tshwane Leadership and Management Academy to demonstrate that embedded generation in City-owned buildings can both improve the reliability of supply (particularly when there is load shedding and outages) and reduce the operating costs of the building.

- **Bylaws & Policies**

The best example has been the development of the Green Building By-law which is now being reviewed and will address incentives and mandatory measures such as rainwater tanks and embedded generation. Another example is the commenting on the Tshwane Landuse Scheme and there was scope to apply the results of the heat mapping study. In our comments, we emphasized the importance of retention of cool and permeable surfaces particularly for developments located in an existing urban heat island.

11.3 CaPS TTT and BEPPSCO Guidance

During the 2020/21 budgeting and reporting cycle, the CaPS TTT and BEPPSCO has facilitated a number of key discussions between infrastructure departments. The objective of these discussions was to inform various role players of crucial planning alignment concerns which have been noted during the compilation of the BEPP and to initiate the process of addressing these concerns. These discussions also formed the framework in which to guide service provision departments to plan capital investment in line with the City's spatial and strategic vision. For more information on the CaPS TTT and BEPPSCO refer to Section A.

One of the more important discussion that was facilitated through the CaPS TTT was between the Roads & Transport and Housing & Human Settlements. This discussion took place on the 13th of February 2020 and was aimed at understanding the planning strategy within each department which includes focus areas and areas identified for investment, together with addressing the issue of silo-based planning.

Housing identified five instruments that are at their disposal to leverage housing development in the City. The first instrument, and arguably the most important one, is the Human Settlements

Development Plan of 2014. The plan serves as the go-to mechanism when the department needs to give input regarding housing and human settlement interventions. The plan is currently in draft format, with an updated version in revision. The second instrument is the Provincial Mega Housing Project. From a local government perspective, this instrument has its limitation, however, still result in housing unit yields. The third instrument is human settlement specific grant, which are specifically focussed for catalytic development purposes. Given the current level of integration, and the requirement from National Treasury that catalytic development occurs in an integration zone, it is difficult to leverage this instrument successfully, as the definition of an integration zone up to this point in time, was space. With the update of the MSDF, this should no longer be an issue. The fourth instrument is the City's budget. Based on the prioritisation model, certain readiness attributes are required per project in order to mature to a budget-able project. Often, these readiness aspects relate to functions and inputs from other departments – which makes it difficult to deliver on projects within the budget. The fifth instrument is a land banking strategy. The strategy is under review and if approved, will enable to City to effectively sell off land on the periphery of the City, and acquire land in areas that will lead to urban restructuring; such as within an integration zone.

Transport identified that it's main focus is to eradicate infrastructure backlog – which can be summarised as a variety of smaller projects per region. The main lever guiding transport are the Integrated Transport Plan, the Roads Master Plan and the Stormwater Master Plan. Transport also indicated that little integration occurs in the planning process between the two departments, and the mandate of both departments overlap with respect to road service provision. This result in confusion and conflict between the two units. The institutional arrangement that followed realties back to the CaPS TTT to facilitate integration and so, alignment.

During the 2020/21 budgeting and reporting cycle, the City also facilitated and attended a number of engagements with the CSIR and CSP coordinator regarding climate change mainstreaming in the built environment. These discussions were aimed at understanding the challenges of mainstreaming climate change within the City and identifying areas for improvement or assistance. The outcome of these discussions included addressing data gaps, integration points between City processes and climate change mainstreaming and aligning the future outcomes of the CAP with infrastructure planning. For more information on climate change mainstreaming specifically focussed on adaptation, refer to Chapter 11.2.3.

Addendum 5 includes the agenda, attendance and meeting notes from both the transport and housing discussion and the climate change mainstreaming discussions.